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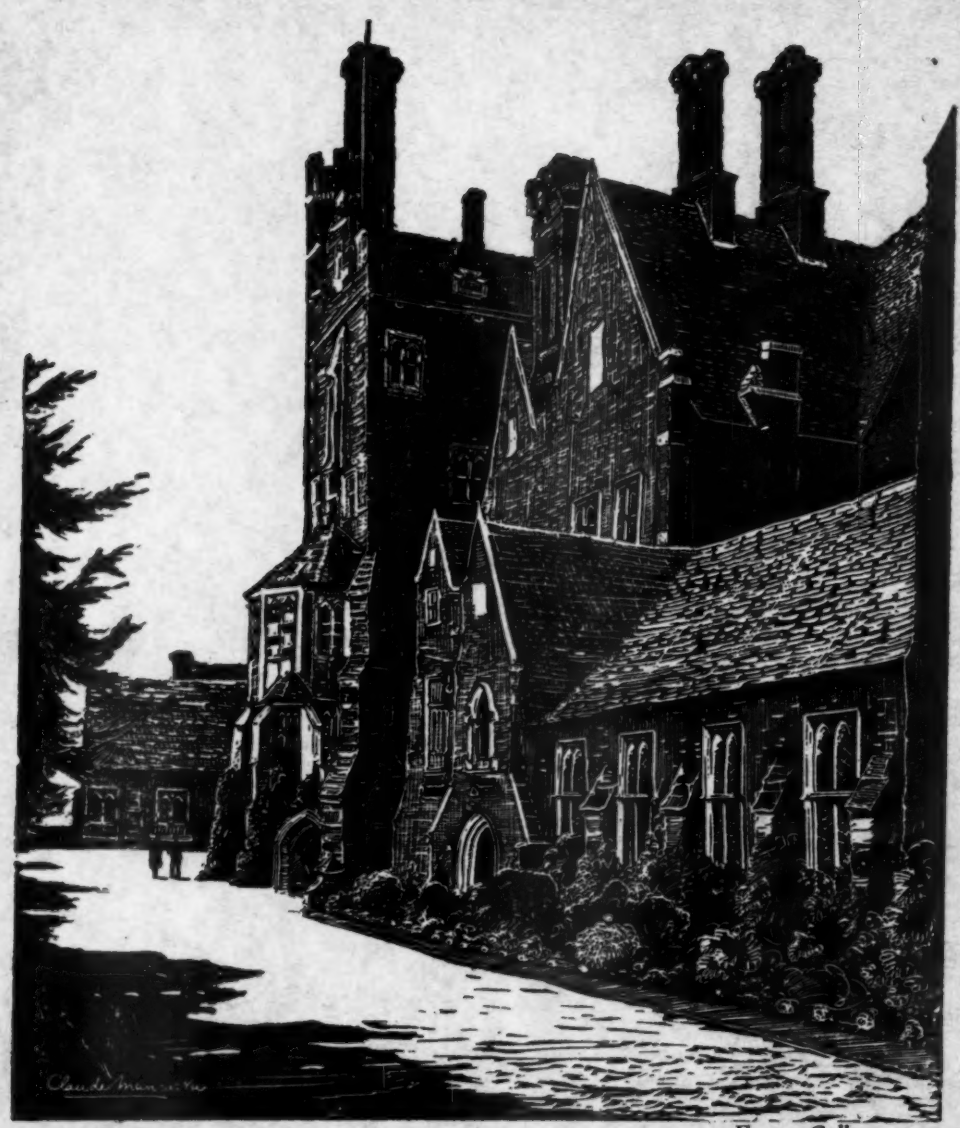

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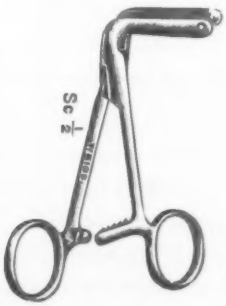

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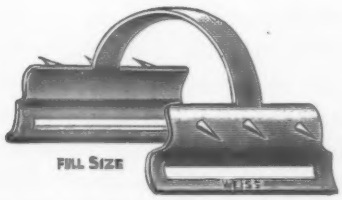

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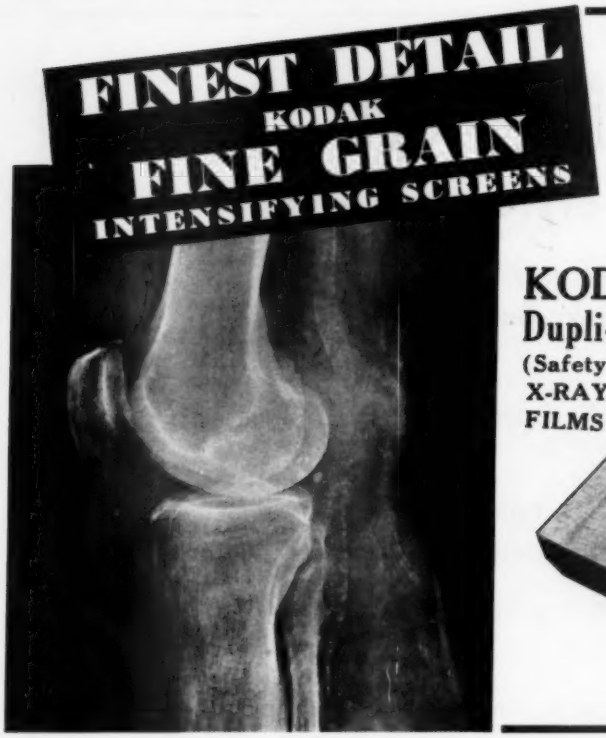

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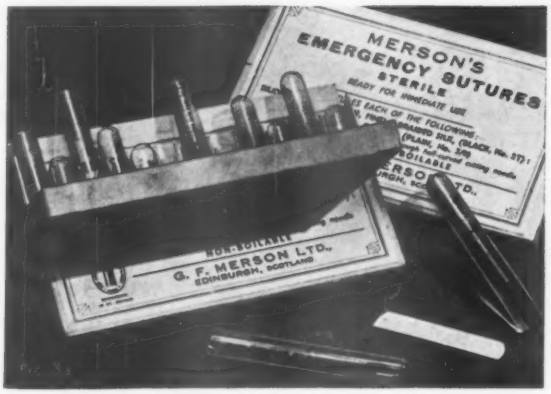

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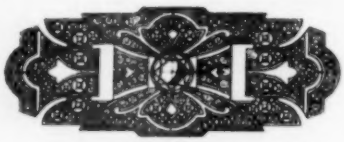

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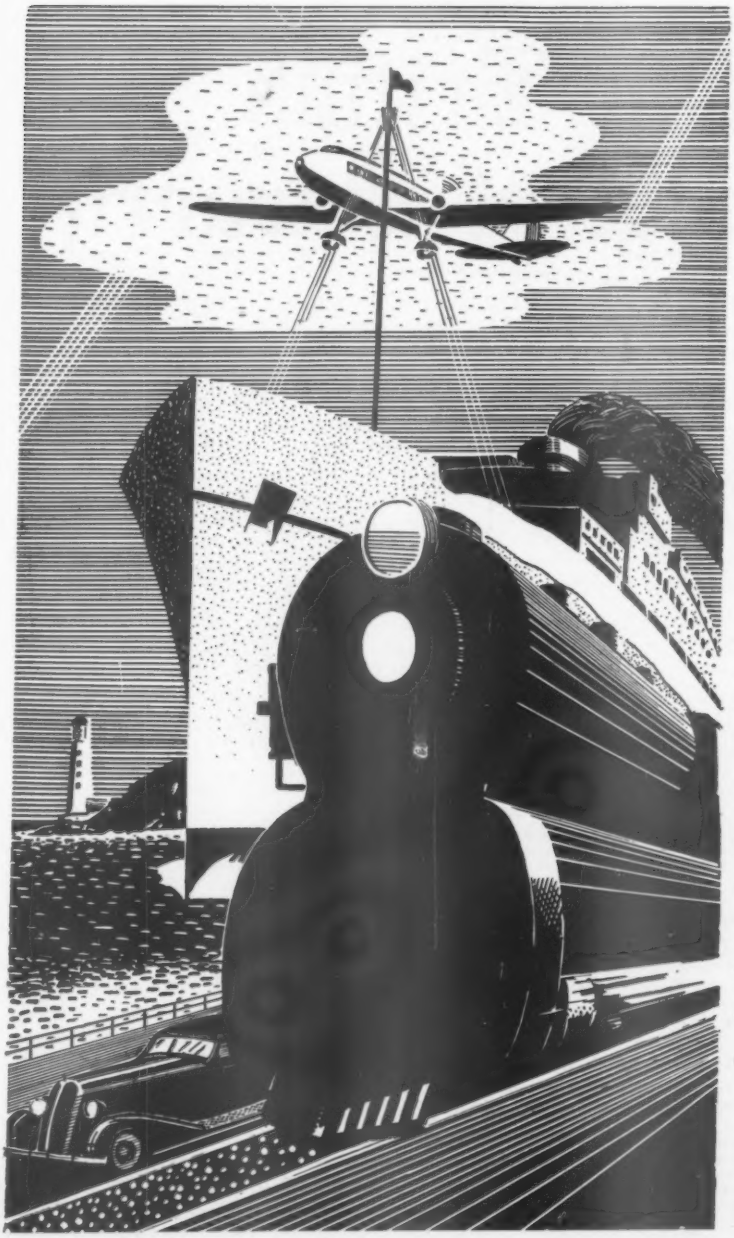

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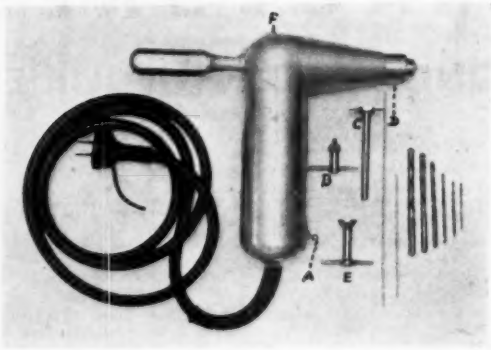

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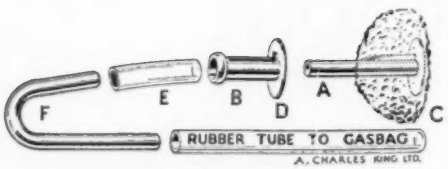

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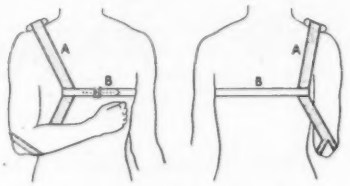

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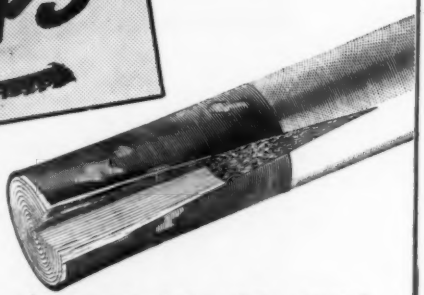

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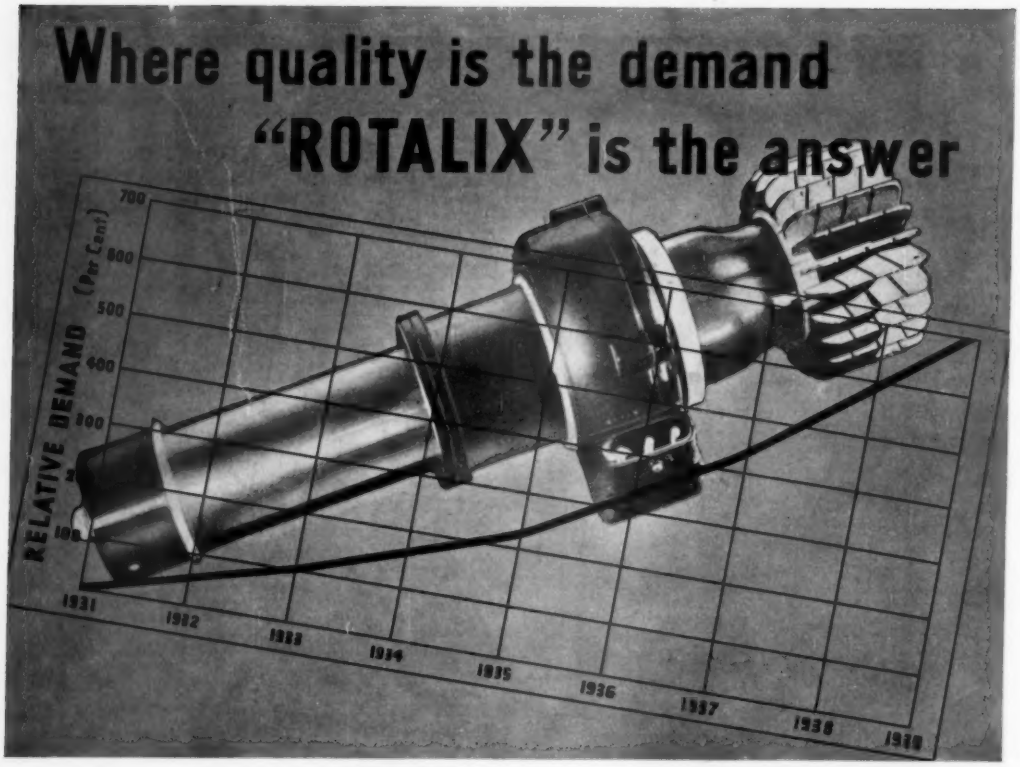

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The Australian and New Zealand Journal of Surgery

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THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY

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VOL. IX. APRIL, 1940. No. 4.

J. H. WEBB AND THE EARLY HISTORY OF APPENDICECTOMY.[1]

By K. F. RUSSELL,
Melbourne.

SURGICAL attack upon the vermiform appendix is, as everyone knows, a development of the last fifty years in the history of surgery. It was delayed because of the fear of surgical opening of the abdomen. When this fear was allayed by Lord Lister with his antiseptic teaching, and removed by the aseptic methods following upon this teaching, then practical surgeons turned their attention to the appendix. It is thought that appendicitis is a relatively new disease, and it would appear that this is the case. Might one suggest, however, that it is not the disease which is new, but that the development and correlation of signs and symptoms associated with this condition have enabled surgeons to diagnose correctly an old disease.

The earliest pathological specimen of appendicitis extant is one found by G. Elliot Smith and F. Wood Jones during the archæological survey of Nubia in 1907. This was the mummified body of a girl found in a cemetery dating from the fifth century A.D., in the pelvis of which was found a band of adhesions running from the lower part of the caecum to the anterior surface of the sacrum.

Coming to more recent times, it seems from contemporary accounts of the symptoms that the *"passio iliaca"* of the writers of the Middle Ages was in fact appendicitis. Surgeons of the seventeenth and eighteenth centuries spoke of a similar disease under the same name. During the nineteenth century, owing perhaps to more detailed methods of examination, the same disease was called typhlitis or perityphlitis, and finally with the knowledge of the site of the inflammation, it was called appendicitis.

In English-speaking countries deliberate removal of an appendix was first performed on August 24, 1883, by Mr. Charters J. Symonds of Guy's Hospital. The patient suffered from recurrent attacks of pain which were due, as discovered at laparotomy, to a calculus impacted in the appendix.

[1] Accepted for publication on October 17, 1939.

Symonds was followed in 1887 by Sir Frederick Treves, and in 1888-1890 by Charles McBurney, of Massachusetts. It is to McBurney that we owe a great amount of our present knowledge of appendicitis. In 1889, in an article in the *New York Medical Journal,* McBurney gave his description of the point of maximum tenderness in this disease, and in view of the ambiguity of description of this point in current text books it is quoted below:

"I believe that in every case the seat of greatest pain, *determined by the pressure of one finger,* has been very exactly between an inch and a half and two inches from the anterior spinous process of the ilium on a straight line drawn from that process to the umbilicus. This may appear to be an affectation of accuracy, but, so far as my experience goes, the observation is correct."

It is not sufficiently realized in Australia that one of our own surgeons played a not inconspicuous part in the history of appendicectomy. This was Mr. John H. Webb, of Melbourne, who, in 1884, suggested that in all cases of appendicitis laparotomy should be performed.

Webb graduated in England in 1865-1866 with the diplomas of M.R.C.S. (England), L.R.C.P. (London). Arriving in Australia, he set up in surgical practice in Melbourne, and during the years 1883-1908 was a member of the honorary surgical staff of the Melbourne Hospital, when he held the following positions: 1883-1884, assistant surgeon; 1884-1889, surgeon to out-patients; 1889-1891, surgeon to in-patients; 1891-1908, consulting surgeon.

In 1884, in the *Australian Medical Journal,* he described three cases of perforation of the appendix, and in his article, which is reprinted below, he said that in the next case of appendicitis that he saw he would do a laparotomy. Apparently he was denied the opportunity, for he did not publish any cases. Moreover, the present writer has searched through the case histories of patients admitted to Webb's wards and has been unable to discover a case of appendicitis in which operation was performed; in fact, there is no mention of a patient suffering from the disease. This latter fact is not to be wondered at, for during this period at the Melbourne Hospital, and probably in every other hospital in the world, such patients were admitted to the medical wards, and the only time a surgeon was called to see them was when an abscess required to be opened.

This, of course, does not necessarily mean that Webb never did a laparotomy in a case of appendicitis; he may have operated on some of the patients he saw in private practice, but at least we have no record of such an operation.

In the article below it will be seen that Webb very accurately described the point of maximum tenderness in the cases he saw; in point of fact, he described McBurney's point five years before McBurney, though, apparently, he did not place great reliance on this diagnostic point.

"Notes on Three Cases of Perforation of the Vermiform Appendix

by

J. H. Webb, M.R.C.S.Eng., L.R.C.P.Lond."

"Instances of obstruction and inflammatory interferences with the appendix are doubtless not very rare, at any rate not sufficiently so to be interesting from their novelty alone. Yet one seldom hears mention of this

organ in connection with postmortem examinations. In dissecting days it was jocularly alluded to, and though I venture to say that in every medical man's career it must at some time or another have been the starting point of fatal consequences, yet in practice the vermiform appendix seems to be entirely lost sight of, and to have dropped quite out of notice.

"The special indications in affections of the vermiform appendix present are, obstinate constipation, accompanied with early rise of temperature, which rise is persistent, and nearly unvarying. There may be early vomiting, and vomiting may be entirely absent, till peritonitis sets in; local tenderness over the right iliac, intensified over a spot two inches above Poupart's ligament, and the same distance to the right of the median plane. However strange it may seem this tenderness is not always to be detected though it would be thought that a symptom so natural could scarcely fail to be present. Very meagre evidence certainly to guide a physician, or form the basis for surgical interference, and yet if we look back, it was but a year or so ago that hydro and pyosalpinx diseases, whose indications are scarcely, if at all, more marked, occupied exactly the same position. . . . They can be diagnosed with great certainty during life, and may be treated with every wholesome prospect of success. Is there such a future in store for inflammations of the vermiform appendix? . . . My first case happened in a girl, aged 15. Her illness commenced with simple stoppage of the bowels, accompanied with steady elevation of the temperature. No vomiting. After lingering nearly a fortnight, without there having been through the course of the illness, any localised tenderness, Mr. Girdlestone in my absence made the autopsy, and discovered blocking of the minute passage that traverses the appendix; sloughing of the part beyond the stoppage; lymph exudation, with glueing of the neighbouring intestine. We examined the small body, the cause of the mischief and to all appearance it seemed a hard fæcal concretion, having as its nucleus a raspberry pip. . . . This case was never, as far as I recollect, even approximately diagnosed previous to death.

"The next instance occurred in a girl somewhat older, say 18 years of age. . . . Here we had constipation, early and persistent elevation of temperature, and slight vomiting for the first two days. This subsided, till peritonitis became general. There was tenderness, but strange to say it was more pronounced on the left than on the right side, while a swelling could not only be felt but seen, dullish on percussion over the site where the pain was most marked. . . . Ten days after my first attendance the girl succumbed. Dr. Graham and myself made the postmortem.

"We found, as in the case just related, blockage of the appendix, with fæcal concretion, but could not make out a nucleus. There was general peritonitis, with adhesive exudation around the seat of injury. The free end of the analogue was dark and sloughy. There was nothing to account for the pain on the left side. . . .

"The third case occurred last summer, in a middle aged man, whom I had attended on two previous occasions, and had each time removed a mucous polypus growing from the sigmoid flexure, and protruding through the anal aperture. His last illness commenced with constipation, for which he first consulted me; but afterwards seeing him at his home, I chanced to notice his temperature, which was then 101°. There was well-marked tenderness over the right iliac region, very localised. No general tenderness. . . . After

eight days from the first attendance, the patient, without having once vomited, as far as I can remember, suddenly collapsed.

"The autopsy disclosed strangulation of the vermiform appendix. It seems that its free end had been entwined in some old fibrous bands, probably the outcome of a former peritonitis; and thus constricted, the strangulated part, detached from its body, or but slightly adherent to it, was found lying amongst the contents of an abscess, the walls of which, formed by intestines glued together, had recently burst. The intestines were bathed in pus. . . .

". . . As regards treatment, as far as drugs are concerned, from the nature of affairs it is evident that the contents of the pharmacopœia can avail nothing whatever. We must, therefore, as the physic-loving man would say, fall back on the 'divine art', and see what surgery can effect or failing that, through hesitation, timidity, call it what you will, 'Gladstonian policy' if you like, it only remains to smooth the rugged road to death by narcotics, etc. But surely these cases in any stage, short of extremis, should not be abandoned. The mind once made up (our fault is we wait too long) immediate action should take place. I certainly would advise abdominal section, and if I ever have another case go through my hands, I shall open the abdomen, say nay who will. The operation will at least give a chance.

"Should, as in the last case I related, an abscess have broken, I would suggest that the patient, after the peritoneum has been cleared and the abdomen is sewn up, be turned on his side, and that the operation of lumbar colotomy short of opening the gut be antiseptically performed. Through the opening in the back a tube should be gently thrust, so as to drain the contents of the abdominal cavity. Whilst opening a psoas abscess from the back I was particularly struck with the easy way in which this can be done, and if the edges of the wound were subsequently brought together round the drainage tube, most perfect emptying of the belly can be assured, without any danger of subsequent hernia.

"This may appear heroic and fantastical surgery. But surgery is only for those who have 'boldness to accomplish'. Let those who cavil remember, that more lives are lost through faint heartedness than ever are sacrificed through abuse of the scalpel."

ACKNOWLEDGEMENTS.

Webb's article is reprinted from the *Australian Medical Journal* by permission of the Victorian Branch of the British Medical Association. I wish to thank R. E. Fanning, Esquire, Manager of the Royal Melbourne Hospital, for the information about Webb's staff appointments.

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DEFORMITIES AFFECTING THE LOWER RADIAL EPIPHYSIS.[1]

By D. J. GLISSAN,
Sydney.

THE hand may be deflected forwards radially or medially in relation to the long axis of the forearm by various adverse factors affecting the shaft or epiphysis of the radius.

Madelung's name is associated with deformities in this region, but unfortunately the description "Madelung's deformity" or "Madelung's wrist" is used very loosely in the literature and current discussion to include deformities arising from widely differing causes.

FIGURE I.

FIGURE II.

It is certainly probable that Madelung's original description covered several diverse conditions, since he wrote in 1878, some seventeen years before Röntgen discovered X rays. It would appear, however, that he referred particularly to a condition which had as its main feature forward projection of the distal end of the radius.

I would urge that any description of these deformities should be based solely upon the primary radial discrepancy. Whilst prominence of the head of the ulna is found in constant association with certain of them, it is purely a secondary feature, to stress which will lead to confusion of classification.

Forward deviation of the lower end of the radius is rare. It may be due to a fracture of the shaft of the radius (Figure I) or to a disturbance of

[1] Accepted for publication on July 5, 1938.

growth of the epiphysis (Figure II). The ætiology of the latter type is obscure. Certainly the case for trauma is not proven. It is more frequent in women.

Moore[1] reporting in 1924 two cases of the latter type, drew attention to an area of decreased density towards the medial side of the epiphysis; and Brailsford,[2] whose description is rendered less convincing by his reliance

FIGURE III.

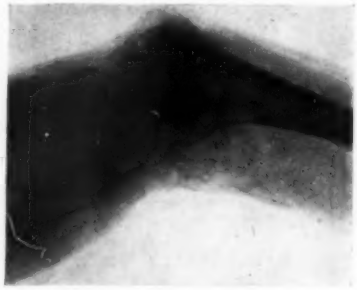

FIGURE IV.

on a diagram to illustrate his point, describes a failure of development of the medial half of the epiphysis as the main feature in Madelung's deformity.

Figure II illustrates one of two cases seen by me in eighteen years. The patient was a young woman, in whom the condition was noted during the course of routine examination. There were no subjective symptoms. No relevant history could be obtained.

FIGURE V.

I have no suggestion to make concerning the ætiology of this condition, but I would draw attention to the fact that the radius appears actually to be lengthened as the result of overgrowth.

This is an interesting point for contrast with the next condition which I wish to discuss, in which the hand is displaced radially (Figures III, IV, V and VI). There can be very little doubt that here we have a totally different lesion, which should not be described as Madelung's deformity.

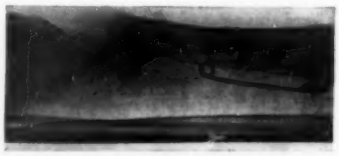

FIGURE VI.

It is more common than the first, and I have seen five patients, all of whom were boys or youths. It is obvious that the underlying pathology is a slowing down and premature cessation of growth at the epiphysis. The radius is shortened and the ulna, continuing to grow, has pushed the hand radially, rendering very prominent its own lower end. In all cases there was a history of slow onset of deformity, following trauma,

which, with one exception, was of a mild type. The exceptional case occurred following open operation upon a displaced epiphysis.

The uniformity in all the features of this deformity suggests a specific ætiological factor. In a search for this it is necessary to review the different types of trauma to which the part is liable.

The lower radial epiphysis successfully withstands many minor assaults during the growing period, but there are two more severe injuries which would seem likely to produce some late adverse effects. These are: (*a*) dorsal displacement of the epiphysis, that is, direct injury to the epiphysis, and

FIGURE VII.

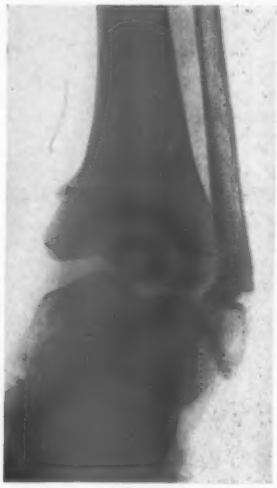

FIGURE VIII.

(*b*) an indirect injury associated with the common buckle fracture (Figure VII), in which the line of force must surely pass at right angles to the line of the epiphysis and subject it to a crushing force.

An examination of the incidence rate of these two commonly encountered injuries and the deformity under discussion shows no parallel, and it would seem certain that the condition is not produced as a late result of these injuries. Moreover, the clinical history which is usually obtained shows that the initial trauma is a slight one.

A point of peculiar and significant interest is found in the fact that a precisely similar condition affects the lower tibial epiphysis (Figure VIII). Brian McFarland[3] has written of this, and points out that it is a deformity peculiar to those parts of the world where area railings still persist to invite small boys to walk upon them. If and when the child falls, one foot is frequently caught between two rails, and an injury is produced which results in the deformity shown. McFarland considers that the essential lesion is a crushing of the medial part of the epiphysis.

In this country area railings are unknown and the condition is rare. I have seen two cases. The first occurred in a small boy who fell from a tree, and the second was seen in an adult woman who in her youth had fallen from a horse, at which time her foot remained caught in the stirrup—a state of affairs which would appear to parallel the conditions noted in McFarland's cases. It would appear reasonable to

FIGURE IX.

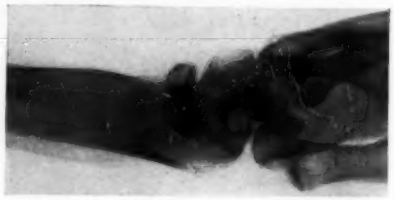

FIGURE X.

assume that in any injury brought about in this manner there must be a torsional strain on the joint and epiphysis, with some strangulation and partial cutting off of blood supply to the latter. Such a hypothesis would explain adequately the interference with growth of the whole epiphysis in the case of the ulna and tibia.

FIGURE XI.

FIGURE XII.

The deformity is unsightly and leads in some cases to such weakness and disability as to cause the patients readily to undergo operation.

In my own cases I chose to shorten the ulna, and it has been my experience that this procedure gives very satisfactory relief. In cases of

gross radial shortening it is difficult to assess the amount of correction to be carried out, in view of the persistence of the growth of the ulna, with its tendency to reproduce the deformity. Operation has been undertaken, therefore, with the reservation that a further final shortening may be necessary when ulna growth has ceased (Figures V and VI).

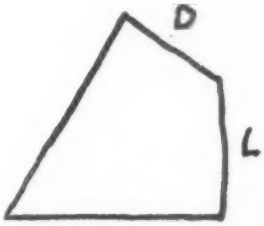

FIGURE XIII. Showing the shape of the template used to outline the bone which had to be removed in order to swing the distal end of the radius into its normal position. D and L represent respectively the distal and lateral edges of the bone segment.

With regard to medial displacement of the hand, this is almost certainly a very rare anomaly. I have seen one case (Figures IX and X).

The patient was a young man whose hand was carried at right angles to the long axis of the forearm, the articular surface of the radius being directed directly medially. The hand was extremely mobile, and was of very little functional use. His history was obscure and difficult to analyse. Whilst the radiographic evidence suggested a congenital deformity, there were signs of old infection about the lower part of the forearm, and he had had osteomyelitis adjacent to one knee joint, which was very disorganized. It was not possible, therefore, to exclude an infective cause of the trouble. A plastic operation was planned to bring the radial articular surface into normal relation with the shaft (Figures XI and XIII).

The ultimate result from every standpoint was extremely satisfactory to the patient and myself (Figure XII).

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COLONIC DRAINAGE: A PLEA FOR CAECOSTOMY.[1]

By W. MAXWELL,
Sydney.

IN discussing colonic drainage, I propose to deal only with the procedure of caecostomy. It has long been recognized that this is an outstanding life-saving operation. It is used mainly for preliminary emergency drainage of the obstructed colon, and less and less as a safety valve following primary resection of the colon.

But it is perhaps wrong to regard caecostomy as merely an emergency measure to tide a patient over a crisis. I believe that no other method of colon drainage is more effective than this simple measure, no matter at what site the obstruction may be situated. An indication of its true value may be gained by a consideration of the relative frequency of obstruction at various sites by carcinoma—the most frequent cause of large bowel occlusion. Approximately 40% of large bowel carcinomata occur in the rectum or at the recto-sigmoid junction, 30% in the sigmoid, and 10% each in the flexures and caecum. In the figures for the flexures are included growths of the corresponding transverse colon, and in those for the caecum the few which originate in the ascending colon.

Thus in 70% of obstructions in which caecostomy is relied upon to tide a patient over an emergency, the occluding factor is situated in the lowermost portion of the large gut—the most unfavourable situation if one agrees with the commonly accepted view that the most efficient drainage is that carried out as near as possible to the obstruction itself.

And yet caecostomy does carry the patient safely over the crisis. I believe also that it is capable of doing more than this, and of draining the whole length of the colon with a degree of success at least equal to that of colostomy lower down.

But before discussing this I wish to refer to the efficiency of these colostomies and also to their expediency.

For this purpose the best example is furnished by a stricture of the lower part of the sigmoid which causes a complete obstruction. Patients with lesions of this type often reach our hands when they have not had a bowel action for several days, and I have had a patient with a history of twelve days' absolute constipation. It may be thought that the most effective preliminary procedure in these circumstances would be a left inguinal colostomy. But this has its difficulties in advanced cases, and I am concerned primarily with advanced cases. In the first place there may not be available a loop of sigmoid or of iliac colon of sufficient mobility to enable it to be brought out through a small grid-iron incision, and with an enormously distended abdomen it is not always advisable to make a rectus incision in

[1] Accepted for publication on May 12, 1938.

order to mobilize the colon. Then with enormous distension of the bowel a larger opening than usual becomes necessary to bring out the loop, and in the infective condition of the latter the wound is very prone to become infected.

One may argue that immediate drainage may be effected here by a large bore cannula and sucker, followed by the immediate insertion of a Paul tube in the loop. But with the semi-solid or solid fæces of this region immediate drainage, so effective in the caecum, is not so easily or so cleanly carried out.

Even when one succeeds in establishing drainage through a colostomy opening, the question arises as to whether the added difficulty and risk are worth while. I hold that they are not, for I have found to my surprise that drainage by a low colostomy does not reduce the bowel below it to anything like normality within three weeks. I have found the same pathological appearances at the second operation when a preliminary colostomy has been performed for chronic, and not acute, obstruction by carcinoma of the recto-sigmoid.

The improvement of the bowel below a left-sided or transverse colostomy then is no better than that found following a well placed caecostomy with proper after-treatment. I would, however, emphasize the necessity for the use of correct methods, as only in this way can efficient drainage be established and the patient kept in proper comfort without leakage and attendant excoriation.

I hold the belief that the view of the greater efficacy of lower colon drainage is a result of what we think should be rather than of what actually is.

This introduces the subject of the physiology of the large bowel in normal health and in obstruction.

In health the colon does not act by succeeding waves of peristalsis, as does the small bowel, but by massive contractions commencing in the proximal colon and rapidly involving its whole length. The radiographers have taught us this from their observations in fluoroscopy of opaque enemata.

In obstruction, two phenomena have been advanced in explanation of the behaviour of the colon. In the first place, reverse colonic peristalsis is said to occur, which means that at least during one phase of obstruction two streams meet in the caecum—one an incoming stream from the ileum, the other a reversed colonic current. This is one explanation of why the caecum often becomes the most distended part of the colon, and, if correct, it would uphold the principle of caecal drainage. This becomes doubly effective if the reversed colonic current is again set up after drainage leads to recovery from the second phenomenon, that is, paralysis of the colon attendant upon continued complete obstruction.

Whether this is true or not, I believe that caecal drainage may be made effective in two ways. In the first place, besides giving the patient paraffin or olive oil daily by mouth, I also run in six ounces of paraffin by the caecostomy tube every second or third day, commencing the day after operation. Immediately following the introduction, the tube is clamped and the patient is treated by posture. Pillows are removed and the foot of the bed is raised for ten minutes; then the patient is turned well on the left side for ten minutes; finally he is restored to the original semi-Fowler position. The idea is to run the paraffin through the transverse and into the descending

colon. After the patient has rested for an hour or two, posturing is again carried out, but in the reverse manner and sequence, in order to restore the liquid content to the caecal reservoir, from which it is then drained.

In many instances this treatment is followed in a few days by a semi-fluid bowel action with flatus, which is thereafter repeated every few days.

It is not surprising that this occurs, for it is generally agreed that a final acute obstruction is often due to the impaction of a firm fæcal mass in an extremely narrowed lumen. How narrow the lumen may become without signs of acute obstruction is a matter which has occasioned the wonder of us all.

Certain points in the performance of the caecostomy and its after-care, however, are essential. In extreme cases the caecum must first be drained by means of a cannula and sucker, so that a soft clamp may be applied to a good knuckle of bowel. A half inch tube is introduced for not more than half an inch into the lumen through an opening just large enough to take it. (I do not use a flanged tube.) If the tube is pushed farther it will not drain, as Moynihan pointed out many years ago, for when the bowel collapses a long tube end will impinge in a groove formed by opposing bowel wall. The tube is fixed in the bowel by a catgut stitch placed with a cutting needle (in an attempt to push a round bodied needle through the tube, the latter may come out and cause soiling) and two or three purse-string sutures invaginate the opening around the tube. Then whether a grid-iron or rectus incision has been used, a separate stab wound is made and the distal end of the tube is brought out through it, together with the ends of the last purse-string suture, which can be used to draw the caecal wall snugly against the parieties and sutured to skin to hold it there. The tube is fixed very firmly to the skin by adhesive plaster; a stitch through skin and tube leads to leakage and infection. Infection is the bugbear of caecostomy. If it occurs in a stab wound, the tube is more likely to slip out and need reintroduction; if in the operation wound through which the tube has been brought out, it may lead among other things to extroversion of the caecum.

In the after-care, apart from the giving of paraffin as already outlined, the things to guard against are blockage and expulsion of the tube. If blockage occurs for two or three hours, a little saline solution is introduced through the tube to clear it—in practice this needs to be done almost every day or so. To prevent expulsion of the tube, it is fixed securely in the first place by strapping to the skin and then inspected closely at intervals of two or three days thereafter. In this way a tube can be kept in position indefinitely, and I prefer to leave it for four or five weeks and then for a further three weeks after the bowel resection. On removal of the tube the stab wound is closed with a deep stitch so that at no time does any drainage reach the skin.

With such a valvular caecostomy it is a simple matter to replace a tube which does come out, providing it is done immediately.

A NEW METHOD OF PERFORMING ENCEPHALOGRAPHY.[1]

By FRANK F. ELLIS,

Flight-Lieutenant, Royal Australian Air Force; George Adlington Syme Research Scholar, 1937.

MANY and varied are the methods used in encephalography, but I propose to deal with the method which I personally have used in the department of neurosurgery at Lewisham Hospital, Sydney.

I intend to attack the subject, firstly, by discussing briefly the indications and contraindications for encephalography, then to discuss the materials used in carrying out this operation. I also intend to make some reference, mainly critical, to the older methods of encephalography, then in more detail to describe the actual method which I have used, and finally to demonstrate some of the results I have obtained, making illustrative use of case histories.

SELECTION OF CASES.

The types of conditions in which encephalography may be used may be listed briefly as follows:

1. The first group comprises post-traumatic intracranial disturbances, and these embrace a diversity of syndromes. Firstly are those following birth trauma. A great number of cases of so-called idiopathic epilepsy have been traced to a more or less difficult birth and encephalography has been of great aid in their elucidation. One case, to be quoted more fully later, is that of a girl of eight years who had been having generalized epileptiform seizures from the age of five months and who had a history of an instrumental birth. On encephalography an extensive area of occipito-parietal cortical atrophy was found.

Patients such as this who have epilepsy, major or minor, and who have a history of a traumatic delivery, are subjects in whom encephalography should often be considered seriously as a diagnostic measure. From a therapeutic point of view, many of the symptoms are often ameliorated following the injection of the foreign medium into the ventriculo-subarachnoid system.

Then there is the case in which symptoms persist or come on after head injury. Even in the absence of any focal signs, encephalography often brings to view some surprising revelations in these cases. An example of this is the following.

Mr. J.J.S., aged twenty-six years, came to us complaining of having had fits during the past four and a half years. These were major epilepsy, lasted about three minutes, and usually occurred every week or fortnight. His worst experience was when he had eight fits in one week. No auræ preceded these attacks. Examination revealed nothing focal, but as he gave a history of numerous head injuries over the past ten years, we deemed him a suitable subject for encephalography, a provisional diagnosis of post-

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traumatic epilepsy being made. He reacted well to the operation and an excellent picture of the ventricular system was obtained. I intend to show later on a lateral view and an extended brow-up encephalogram taken in a similar case, to demonstrate the dilatation of the ventricular system. Suffice it to state here that in the case described, the whole ventricular system was found dilated, and over the right parietal region was found an area clearly outlined by oxygen and showing some calcification. This was taken to be an old area of clotted blood becoming calcified at its edges. Further investigation may be necessary, but up to the present moment the patient has shown such improvement since the taking of his encephalogram and from the "Prominal", three grains of which he is taking every night, that we are tempted to await a further progression, if any, of his condition before attempting any surgical procedure.

2. Another case suitable for encephalography is that rather confusing instance in which an intracranial neoplasm is suspected, as from the symptomatology, but there may be no papillœdema or there may be complete absence of objective signs altogether. Now the comparatively simple procedure of introducing oxygen or air into the ventricular system via the lumbar route may be of immense value in the localization of a tumour, as in the so-called silent areas, whereas otherwise practically nothing can be done except to wait for the tumour, if present, to grow until it reveals itself clinically. The following is an example of this type.

Mr. T.L.A., aged forty-six years, gave a history of an illness that began suddenly four years ago with an attack in which a cigarette fell from his lips. He momentarily forgot where he was and experienced a numbness and tingling in the right side of his mouth and down the right arm. He interviewed a physician, who diagnosed an inoperable cerebral tumour and advised deep X ray therapy. This was employed and he made a speedy recovery and was very well for two years, playing tennis and swimming, until there came a time when he received a blow on the left ear from a tennis ball. This was followed by an attack of aphasia and apraxia, with weakness in the right hand similar to that previously experienced. This attack was accompanied by vomiting and severe frontal bilateral boring headaches. Similar turns to the above have reappeared on numerous occasions since, and additional symptoms present were a tendency to pathological sleep, irritability and fits of temper at home.

He was admitted to hospital for investigation and we were fortunate enough to see him in one of his attacks, in which he exhibited a peculiar relative motor aphasia, being unable to express himself properly and wandering from the point. He complained of the same numb feeling in the right hand and forearm, but there was no sensory or motor loss on examination.

This state lasted about half an hour, and after it was over a complete neurosurgical examination, including an examination of the visual fields on the Bjerrum screen and an X ray examination of the skull, was made, but nothing abnormal could be discovered.

One could not help feeling a little nonplussed at the negative findings, and the taking of an encephalogram was decided upon to help elucidate the matter. This was done according to the technique that I shall discuss later, and the findings were briefly these: (*a*) No entry of oxygen into the left lateral ventricle was seen. (*b*) A dislocation of the whole ventricular system to the right was discovered. (*c*) A mid-line calcification which, in the lateral view, was shown to be about half an inch behind the mid-point between the nasion and inion, was discovered.

In view of these findings and of the symptoms a tentative diagnosis of a meningioma with partial calcification, growing from the dura in the region of the supramarginal gyrus and extending *en plaque* up towards the falx, was tendered.

The patient came to craniotomy. A parietal flap on the left side being turned down, the dura was found under tension and a brain needle detected the ventricle at a depth of six centimetres with clear fluid under considerable tension. The patient's condition began to deteriorate at this stage, as unfortunately sometimes occurs at the critical moment in brain surgery, and although brain needles were passed in several directions without any solid tumour being detected, the dura could not be opened and the neoplasm, if present, exposed. The flap was closed and the patient was allowed to come out of the anæsthetic. However, he made a speedy recovery from this operation, and,

strangely enough, when seen a fortnight, a month, three months and six months after operation he had no return of his symptoms, and is at present living quite an active and happy life.

3. The tumour of the third ventricle, with its complex and varied clinical syndrome, is another diagnostic obscurity sometimes discovered by the encephalogram. The following is an example of the use of this method in a case of a suspected third ventricular tumour.

Mrs. E.F., aged fifty-two years, gave a brief history of frontal and vertical episodic headaches, increasing in severity over two years; she had nausea and occasional vomiting, deteriorating eyesight and frequency of urine.

Examination revealed an obese, masculine woman with a large prognathic jaw and hirsute upper lip. Examination of the ocular fundi revealed three diopters of papillœdema in each disc; no other abnormal clinical signs were discovered. The visual fields were normal. X ray examination of the skull and a direct X ray examination of the *sella turcica* revealed no abnormality. Encephalography was performed and revealed a discrete but irregularly outlined opacity about the size of a pea and situated in the third ventricle. The right ventricle was slightly larger than the left, probably owing to an intermittent blockage of the right foramen of Munro. The spasmodic headaches could also be explained by the assumption of a recurring relative internal hydrocephalus. The patient is still under observation.

4. Finally, in this brief survey we consider suspected chronic cerebral abscess a condition in which encephalography may be used as a diagnostic method. I have no examples of this to depict to you.

CONTRAINDICATIONS.

Now we must consider those cases in which encephalography should not be undertaken.

1. Raised intracranial tension due to any cause should be taken as a contraindication to encephalography until it has been determined that the cause of this raised pressure is subtentorial in origin. Otherwise the risk of sudden death in the encephalogram chair from bulbar compression is very great. One only has to see a craniotomy performed in a case of cerebellar tumour when the pressure in the posterior fossa is raised and to see how the cerebellar tonsils and the medulla extend into the very jaws of the *foramen magnum*, to realize how in the process of encephalography these contents of the posterior fossa could be hopelessly and irrevocably jammed in the *foramen magnum*, with consequent medullary compression and an instant respiratory death. Once, however, the cause of the intracranial hypertension has been satisfactorily determined as arising above the tentorium, a careful, small-volume encephalogram is not contraindicated when lumbar puncture pressure readings are even considerably above the normal.

2. Encephalography again should not be carried out too soon after head injury owing to the risk of determining a secondary cerebral œdema. If an encephalogram is decided on, sufficient rest in bed to permit the dislocated cerebro-spinal circulation of fluid to become stabilized is eminently desirable. Each case is a law unto itself, but on the average at least three weeks should be taken as the safe limit. Furthermore, this time permits any persistent intracranial trouble either to declare itself clinically or at least to become more or less localized.

3. A degenerated arterial system, especially if revealed in the *fundus oculi* and more especially if associated with arterial hypertension, can be considered as a contraindication to encephalography for fear of cerebral hæmorrhage.

SELECTION OF THE CONTRAST MEDIUM.

Now we come to the consideration of the substance to be inserted into the subarachnoid and ventricular systems, which will act as an outlining agent on radiography by contrast against the transradiant intracranial contents. This substance is known as the contrast medium and to judge our selection of it we must take the following into consideration: (*a*) It must contrast against the intracranial contents and the skull bones on radiography. (*b*) It must be non-toxic and non-irritant. (*c*) It must be readily absorbable from the ventriculo-subarachnoid system. (*d*) It must have no after-effects. (*e*) The medium should be easily procurable and it must be sterilizable.

Now we have a number of media from which to make a selection and which we shall consider from these points of view. Firstly, air. This is probably the most widely used substance in encephalography and ventriculography, and is satisfactory in that it is readily available and gives good X ray pictures; but it has the disadvantages of being somewhat irritant and tends to produce post-encephalographic symptoms, especially headache. Further, from a study of serial skiagrams taken after encephalography with air, traces of the latter can be seen in the ventricular system up to three months following its introduction. This is due to the high nitrogen content of air, and it appears that many of the after-effects in the way of headache, vomiting and malaise run concurrently with the absorption of, at any rate, the bulk of the injected medium.

Oxygen has been introduced in an effort to overcome some of these side-effects of air injection and very satisfactory results have been found to follow its use. From a radiological point of view oxygen is not quite so good a contrast medium as air, but it must be emphasized, if use is made of stereoscopic X ray pictures, that excellent pictures can be obtained with oxygen encephalograms. One of the great advantages of oxygen is that it is so readily absorbable from the ventricular system and the subarachnoid spaces. To prove this, encephalograms were taken immediately after the use of oxygen, and in the second film it was seen that practically all the contrast medium had been absorbed. A further skiagram at sixty hours showed complete absorption of the oxygen. Thus it is of great advantage to have such a readily absorbable and easily obtainable substance as oxygen as a substitute for air, and it has been adopted for routine use at Lewisham Hospital in pneumographic work.

Of the other substances used, three only bear mention.

Ethylene has been used and is quite satisfactory, but against it is that it is not a good contrast medium and also it is not easily procurable. It is rapidly absorbed—in about eight hours.

Nitrous oxide is even more rapidly absorbed; in about two hours very little is left to show up in the radiographs, and even in radiographs taken immediately after its injection it gives a very poor picture of the ventricular system.

Finally, "Thorotrast", which has been tried experimentally, but was found to be dangerous. I shall read to you an extract from the *Archives of Neurology and Psychiatry*, Volume xxxviii, Number 2, August, 1937:

> Stabilized colloidal thorium dioxide exerts a transitory inflammatory reaction in the choroid plexus, ependyma and meninges. In cases of ventricular obstruction

profound inflammatory changes may ensue, with suppurative ependymitis, desquamation of the ependyma and formation of plaques and masses of thorium in phagocytes on the denuded surface of the ventricles.

So, from these considerations and bearing in mind the requirements of the ideal medium, I think we can safely say that in all usual cases coming to encephalography oxygen fills the bill better than any of the other substances used.

DISTURBANCES IN ENCEPHALOGRAPHY.

Reference will now be made to the various disadvantages of the older and cruder methods of encephalography to serve mainly as a contrast to the more recent developments which I shall expound later.

Probably the commonest way of performing encephalography is with the conscious patient, with or without a preliminary injection of morphine, sitting in a chair. The inconveniences and ill-effects to which the patient is liable will now be dealt with as early and late phenomena.

Immediate Ill-Effects.

Firstly, shock, which may be due either to the injection of the medium used or to the depletion in small or large quantities of cerebro-spinal fluid, sometimes comes on very suddenly, with pallor, sweating and sometimes dramatic changes in the pulse, either in the way of a rapid, shallow pulse or a frightening bradycardia, shortly after the operation is commenced.

Then vomiting, due to a central effect, is not an uncommon concomitant of encephalography when local anæsthesia only is used, and may even become distressing and prolonged with marked dehydration of an already shocked patient.

Sudden complete collapse and even death are fortunately a rare happening during encephalography, but it has occurred. It is probably due to the severe sudden dislocation of intracranial conditions, with a central nervous system unprotected by anæsthesia, providing bulbar compression or pathological changes in an intracranial neoplasm can be excluded.

Severe lancinating headache is probably so common that he should be forewarned against it should encephalography be intended on a conscious or, at the best, partly amnesic patient under morphine premedication.

Late Ill-Effects.

A permanent upset in the cerebro-spinal circulation may be caused following encephalography, and may result in post-encephalographic intracranial hypertension with symptoms of headaches, giddiness, nausea, lack of concentration and sometimes visual disturbances. Fundal examination will sometimes reveal an early blurring of the disk margin; a lumbar puncture in these people will yield a raised pressure reading, and repeated lumbar punctures are necessary to reduce the intracranial pressure factors to normal. Fortunately, intracranial hyperpressure changes are very infrequent sequelæ to pneumography.

METHOD USED.

We now come to consider the method of encephalography which I have employed in twenty-six cases this year at Lewisham Hospital and in a further seven cases in a country hospital since.

I shall deal with the whole technique from the admission of the patient, then, tracing through the steps of the operation, shall also give a detailed description of the apparatus used.

The patient is admitted to hospital on the evening before operation and examined with the object of excluding raised intracranial tension, a lumbar puncture being performed if considered necessary. The patient is weighed, and an enema given that night, and in the morning, three-quarters of an hour before the intended operation, he is given a basal dose of "Avertin" by the rectum; half an hour after this he is taken to the X ray department.

One of the many advantages of "Avertin" is that the patient, when brought to the encephalogram chair, is sufficiently anæsthetized as not to stir during the operation, yet is not completely atonic and so can be postured as shown in the accompanying photographs (Figures IA and IB).

FIGURE IA. Posture of the patient in the Beckwenn chair following an "Avertin" anæsthetic.

FIGURE IB. Posture of the patient in the Beckwenn chair following an "Avertin" anæsthetic.

An ordinary chair with the patient sitting "astraddle" may be used, but we prefer the Beckwenn chair with the head resting on the head-piece as shown and the arms bandaged for support.

The encephalogram set-up as shown in Figure II consists of an oxygen bag, which is first filled from the cylinder, and connected by a three-way tap to a 50 cubic centimetre syringe, the third tap taking the tube to the lumbar puncture needle. The syringe can then be filled with oxygen and by turning the tap the oxygen can be injected into the patient's lumbar sac.

TECHNIQUE.

The patient having been postured as described and the 50 cubic centimetre syringe of oxygen being ready, 1% "Novocain" solution is injected under the

skin and two lumbar puncture needles are passed into the patient's lumbar subarachnoid space. One needle is passed between the third and fourth lumbar spines and another between the fourth and fifth. Twenty gauge needles are satisfactory for this purpose. The small amount of local anæsthetic used is to prevent movement in the chair caused by the irritation of the needles as they pass through the skin. The cerebro-spinal pressure is estimated with an ordinary open-tubing manometer from the upper needle. The manometer is then removed and the tubing from the oxygen syringe is connected by an ordinary adaptor to this upper needle. When all is ready for the injection and the patient's head is postured and held as shown, the operator takes the syringe with the three-way tap turned to the lumbar puncture needle, removes the stilette from the lower needle and commences the injection of oxygen (Figure III).

FIGURE II. The apparatus for the injection of oxygen. The bag is filled from the oxygen cylinder and connected by a three-way tap to the syringe and spinal needle. The second needle is also shown.

The rationale of the two-needle technique is that whilst the oxygen is entering the upper needle and so tending to raise the cerebro-spinal pressure, the lower needle acts as a vent for escape of excess cerebro-spinal fluid and also affords an accurate gauge as to the amount of force required with the injecting syringe, a steady flow of fluid from the lower needle being aimed at. Depending on whether a large volume encephalogram, in which the whole ventriculo-subarachnoid spaces are filled with oxygen, or a small volume one is desired, the amount of oxygen injected may vary from 25 to 150 cubic centimetres or even more.

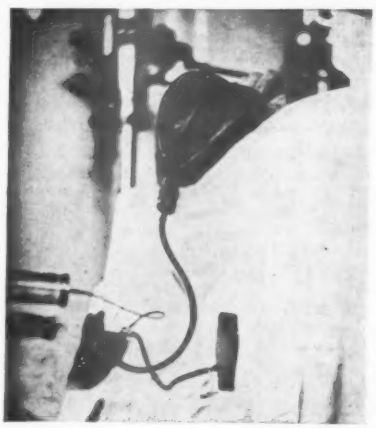

FIGURE III. Showing the two needles *in situ* and the operator turning the three-way tap just prior to making the injection of oxygen.

Even with "Avertin" anæsthesia the entry of oxygen into the ventricular system causes the patient a certain amount of upset, manifested usually by some pallor, and this can almost indeed be taken as a guide to the successful entry of oxygen into the ventricles. The operation can be stopped at this juncture, or, if desired, more oxygen can be injected, in which case it will rise and spread about the cerebral convolutions.

On completion of the oxygen injection the cerebro-spinal pressure is measured once more, and, if raised, is allowed to settle down to its former level by allowing cerebro-spinal fluid to escape from the lower needle. Both needles are then withdrawn and the puncture wounds are sealed with strapping. The patient is then wheeled in the Beckwenn chair up to, and lifted onto, the X ray table.

A procedure that I sometimes carry out if I am not sure that the oxygen has entered the ventricles is to make a short lateral exposure to the X rays whilst the patient is still sitting in the chair and with the stilettoed needles *in situ*; on development of the film a decision can be made whether further oxygen injection is necessary or not. This may save the necessity of performing another encephalogram at a later date.

RADIOGRAPHS TAKEN.

As a routine, postero-anterior (that is, brow-up) stereograms are taken first, and if no encephalogram was taken whilst the patient was in the chair (*vide supra*) these two films are developed and viewed immediately, and any local pathological condition that is shown up can then receive close attention in the ensuing exposures. If nothing is seen, lateral stereoscopic radiographs are then taken, sufficient time being allowed on each turning of the head to permit as much oxygen as possible to enter the respective ventricle. A final and most helpful radiograph is then taken with the patient's head hyper-extended and with his shoulders raised on two pillows; the plate is held at the side of his head to obtain a lateral picture with as much oxygen as possible in the anterior horns of the ventricles. This is done because frontal scars and diverticula can sometimes be picked up in this radiograph, whereas they may be missed in the ordinary lateral stereographs.

RESULTS.

This method of encephalography having been dealt with in some detail, we come to a brief review of results obtained. I shall consider these, firstly, from the patient's point of view, and, secondly, as to what we have found in the way of neurosurgical material, and I shall show two typical encephalograms.

Effects on the Patient.

The introduction of "Avertin" has been a great boon to encephalography, and it is reflected in several ways.

Firstly, the patient being perfectly still, it makes the technique so much easier than it is when "Avertin" is not used. It allows a more successful attempt to fill the ventricular system, the oxygen having a much greater chance of entering the foramina of Magendie and Luschka to the satisfaction of the operator when the patient is easily and properly postured and the head held at the optimal angle for this to occur.

Secondly, from the patient's point of view, with "Avertin", encephalography comes into the realms of a purely investigatory procedure and is suitable in a greater number of cases than previously. Indeed, with the old method of performing the operation under local anæsthesia with morphine premedication, owing to the distress occasioned the patient and the necessarily prolonged stay in hospital, encephalography had been almost completely abandoned at Lewisham Hospital, except in a few cases in which the procedure

was almost imperative for diagnostic purposes. Now the patient need stay in the hospital only a matter of three or four days, suffering but little inconvenience and certainly no disability.

Some Case Histories.

The following cases are illustrative of the success of this method and also serve as an indication as to the types of condition in which we practise encephalography.

CASE I.—The first case is that of Miss N.M., aged eight years. This case has already been referred to briefly in the remarks on selection of cases suitable for encephalography.

The patient came to us at the age of eight years, having been treated for Jacksonian epilepsy in Newcastle at various times over a period of four years. She had been having seizures since the age of five months, and these had been increasing in severity and frequency up to the time of examination; they were major convulsions for the most part, with interspersed occasional minor turns. During the preceding twelve months they were approximately a fortnightly occurrence and lasted only for some minutes; but about twice a year she would enter into a *status epilepticus*, lasting over a period of from one to two hours. She had been a full-time baby and an only child; birth was instrumental, but she had had no head injuries since birth.

Examination revealed some loss of tactile discrimination in the right forearm and hand and a failing off of power of the right lower face. The fundi were normal, the visual fields full, and no further clinical findings could be elicited. Intellectually the child was backward. She was admitted to hospital for encephalography with a tentative diagnosis of left parietal neoplasm, probably meningioma.

Encephalography was carried out according to the regime described above. During and after the operation note was taken of the patient's condition, and it was found that the pulse remained regular and well formed between eighty and ninety beats a minute throughout, her colour was excellent and there was no sweating at any time. She recovered consciousness seven hours afterwards, but with a tendency to further sleep. She did not vomit once and wakened the following morning with no headache and no nausea. She was discharged four days after the encephalogram was taken to continue as an outdoor patient pending further operative treatment.

The encephalograms showed what was taken to be a large traction diverticulum in the left parieto-occipital region involving the cortex overlying the parietal and occipital horns of the left ventricle. The cortex in this region was judged to be thinned out to about one inch thickness and the rest of the ventricular system dilated to some extent. These findings were strikingly illustrated when the films were reviewed on the stereoscope. Subsequently, in spite of the extent of this brain scar, it was thought advisable to perform an investigatory craniotomy and, if possible, to excise some or all of the gliosed cortex which obviously was acting in an epileptogenic manner.

Three weeks later a flap was turned down over the left temporo-occipital region, but on elevation of a bone flap and incision of the dura a very diffuse gliosis involving the whole area under view was found, and apparently it extended forwards and backwards over the whole of the hinder part of the left cerebral hemisphere. No further operative procedure was considered advisable and the scalp was closed, a large decompression being left. The post-operative condition was excellent and the convalescence uneventful. A follow-up revealed a marked improvement in the child's mental condition and a very definite amelioration in both the severity and frequency of the turns.

In this case I should like to bring out the following points:

1. Birth trauma as a potent source of epilepsy.

2. The distinct possibility of localizing and sometimes relieving the effects of such birth injury.

3. The relative ease with which encephalography can be carried out in these cases, providing the system I have described is adhered to.

CASE II.—The second case is that of Master R.W.D., aged eight years.

This child, rather similar to the preceding, had been having major epileptiform seizures for a period of two years when first seen at the outdoor department. He was the sixth of seven children and had had a difficult but not instrumental birth.

The only distinctive features about the fits were their frequency—twenty to thirty such attacks occurring successively every second day—and also that during the seizure the head turned to the left and the left arm moved across the chest. We were fortunate enough to see the patient have one of these fits, and its duration was about one minute and a half. His mother further stated that he was very backward mentally and added that the mental deterioration had been rapid during the past six months. Examination revealed nothing except the obvious intellectual retardation and postural holding of the head to the left side. Medical treatment was instituted and maintained over a period of three months, the patient being treated with calcium, "Luminal", "Prominal" and ketogenic diet with no apparent success.

He was then admitted to hospital for encephalography, which was performed by the routine method described. During the operation no constitutional disturbances could be detected, there being no shock and the pulse remaining below one hundred beats throughout. He recovered consciousness three and a half hours later, and gave no evidence of having headache, and he did not vomit at any stage. He was discharged two days after the operation to continue as an outdoor patient.

The encephalogram, in the preparation of which 85 cubic centimetres of oxygen had been injected, showed a fairly well-filled ventricular system with a considerable amount of gas over the cortex. No focal abnormality, however, was revealed.

The follow-up of this case is rather impressive; whereas previously twenty to thirty fits on alternate days were quite the rule, when seen three weeks after the encephalogram the patient had had only seven "turns" altogether. One month after the operation a remarkable change from the mental aspect was obvious; whereas before the patient had been a drooling idiot-child, he now took quite an intelligent interest in his environs, he did not dribble, and he held his head erect.

The points of interest I should like to stress in this case are:

1. The immense value of encephalography as a therapeutic agent in cases of idiopathic epilepsy, it diminishing the number and severity of the turns, especially if coupled with adequate medical treatment.

2. The marked improvement in the mental state following encephalography.

CASE III.—The third case is that of Mrs. M.R., aged forty-six years.

This patient was first seen nineteen months ago, and came complaining of loss of memory, of attacks of automatism and of trance-like states over a period of twelve months. During this time she had had twelve such attacks, and they were becoming worse with the passage of time. She also complained of headaches and of an oppressive feeling over the vertex of her head, and also told me of strange hallucinations of taste and smell preceding these turns.

Examination at a later visit revealed a definite swelling of the lateral margin of the left optic disk and a fullness of the retinal veins. The visual fields were examined on the Bjerrum screen and evidenced a small upper nasal quadrantopsia on the right side. No further findings were elicited, and she was treated medically for well over a year, but no great improvement occurred and so she was subjected to encephalography.

No evidence of any causal factor was found in the pneumograms, but ten days afterwards she reported to the out-patients' department and told me, in her own words, that she "felt wonderful and had never been so well". She had lost the oppressive feeling and was able to rise from her bed, feeling perfectly clear in the head. She is still under observation as an out-patient, and her progress will be closely studied.

CASE IV.—The fourth case is that of Mr. C.S., aged forty-seven years.

This patient, a dentist, had been having peculiar turns during the two years previous to his coming to see me at the out-patient department. He described these as first a "hot-smell sensation" followed by a feeling of unreality and abstraction. These would come on for several days at a time, but he would suffer remissions for periods of from one to two months, during which time he was perfectly free from them. He

stated that during the last seven or eight months these attacks had been becoming worse and, if anything, more frequent in occurrence, and he also told us that in the course of the last month or so he had almost completely lost his senses of taste and smell.

Examination revealed a relative anosmia to the smell test-bottles, this abnormality being more pronounced with the right nostril. Further examination revealed nothing except a fullness of the fundal veins and a slight lower facial weakness, more marked in repose and on the left side.

A skiagram of the skull was ordered and this showed what appeared to be a calcification of the right sphenoidal ridge, which could possibly, by pressure on the temporal lobe, account for these strange disturbances of his senses of smell and taste. However, an attempt to verify this finding by the taking of right lateral stereoscopic skiagrams failed to reveal any abnormality of the sphenoidal ridge.

I then observed the patient over a period of one month, and at the end of this time, as the symptoms seemed to be progressing and to be causing him some considerable distress, the patient was submitted to encephalography in the hope of finding something localizing in the right temporal horn.

To accomplish this the angle at which the tube was placed had to be adjusted in the taking of one film to give a detailed view of the oxygen in the right temporal horn, and this was done by taking a postero-anterior view with the patient's head lying on its left side in order to bring the contained oxygen into the uppermost, that is, the right temporal horn, of the ventricular system. This gave an excellent picture, but failed to reveal any abnormality. Stereoscopic encephalograms of the routine postero-anterior and lateral views also showed no pathological change.

However, two days following the operation, during which the patient suffered some slight matutinal headache, he called me to this bed and announced that his olfactory sense was returning because that morning he had smelt the methylated spirits which had been daubed on his points of pressure by the nurse, and also had for the first time since his admission three days previously smelt the polish used on the floor of the ward. This finding was striking and the improvement continued. He was discharged two days later, and at his last visit a fortnight later a marked improvement was noticed in his reaction to the test smelling bottles. His further progress will be keenly followed, as he told me that he had had no further "turns" since his encephalogram was taken.

CASE V.—The last case that I would discuss is of particular interest in that the encephalography was carried out in a New South Wales country hospital, and is, as far as I am aware, one of the first encephalographies to be performed outside the metropolitan districts. The case is that of Master H.B., aged fifteen years.

This boy first came to me three months ago with the following history. He sustained a concussion three years ago, but received no medical treatment until three weeks after the accident, although at the time of injury he was unconscious and afterwards displayed retrograde amnesia of incidents leading up to the accident. Three weeks after the accident he lost some blood from the ears and consulted a doctor, but was declared quite fit. That was all in the history at the time of the accident and there was no previous history.

During the last nine months he had suffered from the following: (*a*) increasing fatigability and lack of concentration; (*b*) unsteadiness of gait; (*c*) heavy feeling in frontal regions, increased on stooping—"feels forehead is bulging"; (*d*) loss of memory, increasing; (*e*) gradually, the onset of incipient epilepsy, starting first as an occasional *petit mal* and then with more frequency until within the last two or three months major epilepsy with loss of consciousness for short durations and occasional attacks of automatism, during which he might be destructive and sometimes klepomaniacal.

On examination the facies was suggestive of mental deterioration, and he would sit in the consulting room with a rather stupid expression on his face, gazing at nothing for long periods of time. Examination of the nervous system revealed only exaggerated knee jerks on both sides, but no other abnormality. The fundi and visual fields were normal. Incidentally, enlargement of the tonsils was noted.

He was admitted to the Bathurst District Hospital and was submitted to lumbar puncture on the next day, with the following findings. The cerebro-spinal fluid was clear and had a pressure of 130 millimetres of water; a sample was tested and the amount of protein was found to be 40 milligrammes per 100 millilitres of fluid, that is, it was slightly increased. There were no cells of any kind in the fluid.

The spinal puncture brought about a temporary relief of the headaches, but they soon returned.

Reviewing the situation at this juncture, I felt that all his symptoms were referable to the head injury three years previously, and that the train of events was due to a persistent post-traumatic intracranial hypertension, with perhaps the existence of a

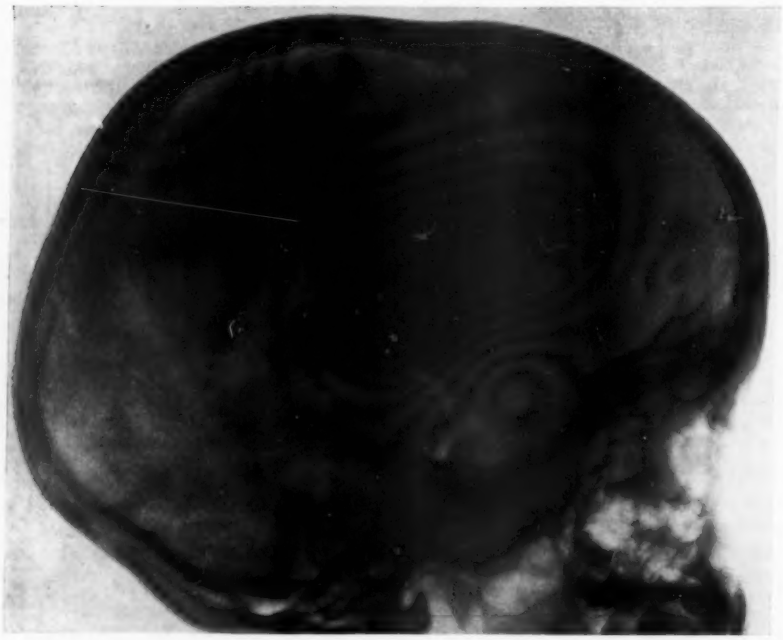

FIGURE IV. An encephalogram showing a somewhat generalized ventricular enlargement with good filling of all the ventricles and some cortical atrophy.

few fine adhesions between the cortex and leptomeninges, which might be causing the epileptiform seizures. With this in mind, I decided to submit the patient to encephalography from the point of view of both diagnosis and therapeusis. The method used I have described fully above.

Following the operation the patient was still sleeping, but roused on movement and exhibited photophobia. His colour was excellent, the breathing even and natural, and the pulse rate remained at about eighty-four beats per minute throughout. He was returned to the ward, where he vomited a small amount of mucus, and then sank into an apparently natural sleep for over ten hours. On waking he complained of a slight headache, which was completely relieved by one aspirin tablet.

On review of the encephalograms the ventricles appeared to be well filled, and there was oxygen on the surface of the hemispheres. In the postero-anterior view the ventricles appeared equal and normal in size and position. In the lateral views the amount of oxygen over the surface of the frontal lobes was excessive, probably owing

to some cortical atrophy. The extended brow-up lateral view also confirmed this, and showed some bilateral dilatation of the anterior ventricular horns.

These results fit in with the clinical picture, and were certainly due to the head injury three years previously.

Following the encephalography the patient made a rapid recovery during his stay in hospital and after his discharge a fortnight later, as evidenced by the following features:

1. Complete freedom from headache.
2. A rapid improvement in his memory, the first sign of which occurred on the day following the encephalography, when he called me to his bed and told me he was

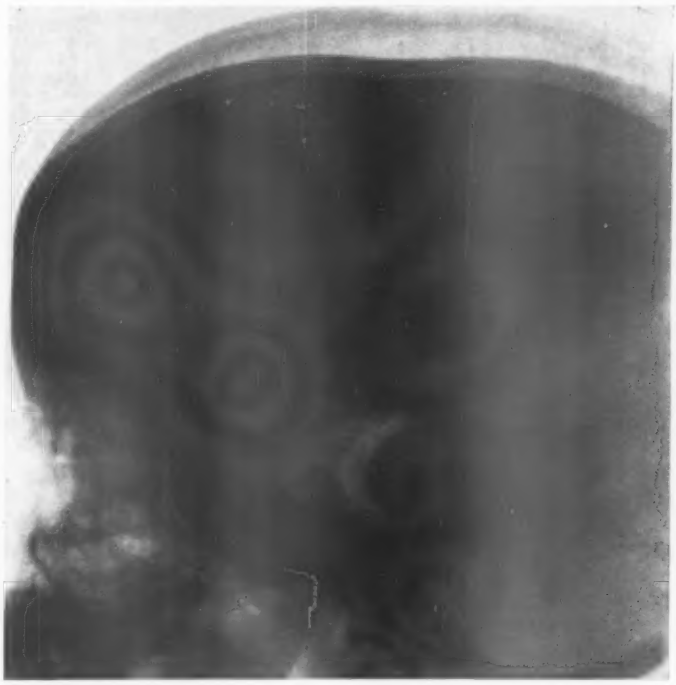

FIGURE V. An example of the extended brow-up encephalogram, the skiagram being taken from the side to show up more fully the anterior horn of the lateral ventricle. In this case the anterior horn is somewhat dilated.

remembering names of people and places he had forgotten. This surprising development continued, he remembering such intricacies as the timing and setting of gramophone motors, the spark gaps of combustion motors and the winding of wireless coils, all things which he had been told within the last twelve months and had forgotten.

3. A gradual improvement in the facies and general appearance. His mother remarked on his more intelligent appearance, and he himself told me he was feeling brighter and more energetic and more able to concentrate.

When he was seen one month after his discharge from hospital, his memory was excellent and he had no headache at all, he looked brighter and felt happier, and told me that he actually remembered the accident, previously blotted out by retrograde amnesia.

He will shortly be readmitted to hospital for tonsillectomy.

The following features in this case are to be stressed: (*a*) the ease with which encephalography can be carried out at any hospital, provided the technique described is adhered to; (*b*) the freedom from discomfort and danger with this technique; (*c*) the positive findings in the actual pneumograms; (*d*) the interesting improvement in the patient's memory, probably due to the breaking down of fine adhesions between the cortex and meninges.

Encephalograms Showing Abnormalities.

The two further accompanying encephalograms, together with those that have already been described, are exemplary of the type of pathological condition we have encountered, the technique used in each case being that which has been described above.

The first encephalogram shows a somewhat generalized ventricular enlargement with good filling of all the ventricles and a cortical gliosis, which is localized over the left side (Figure IV). This patient had had a craniotomy two years previously with negative findings.

The second view is inserted as an example of the extended brow-up skiagram, the skiagram being taken from the lateral aspect to show up more fully the anterior horn of the lateral ventricle. In this case the anterior horn is somewhat dilated (Figure V).

I do not include more encephalograms, as, being only shadows and best seen on the stereoscope, they do not photograph well.

CONCLUSION.

The above dissertation has been based on thirty-three cases, seven of which occurred in a country hospital; but the excellent results obtained have been so striking that it is felt that, apart from minor modifications, the technique could easily be instituted in any hospital where the full investigation of neurosurgical cases is to be carried out.

ACKNOWLEDGEMENT.

I express gratefully my acknowledgements to Dr. Gilbert Phillips for permission to use case histories and skiagrams.

THORACOPLASTY IN PULMONARY TUBERCULOSIS: A GENERAL SURVEY OF FORTY-SEVEN CASES.[1]

By A. M. Hutson,
Medical Superintendent, Austin Hospital, Melbourne.

Introduction.

The value of collapse therapy in the treatment of pulmonary tuberculosis with cavitation has been appreciated for many years. It may be stated as a general rule that a cavity of any considerable size forms an urgent indication for some form of collapse therapy, and the ultimate fate of the patient depends largely upon the efficacy of that treatment.

The principles of treatment by artificial pneumothorax have gradually become standardized, and the production of a pneumothorax is undoubtedly the method of choice for the majority of patients requiring pulmonary collapse. For those patients in whom collapse is necessary, but the production of a pneumothorax has proved impracticable, the problem of treatment is more difficult. From time to time various operative measures have been devised, the aim of which is the production of pulmonary collapse and relaxation by resection of portion of the rigid thoracic wall.

Although the basic principles underlying thoracoplasty have been well defined, there is still considerable difference of opinion concerning the most suitable type of operation and concerning the indications for operation in the individual case.

During the past eight years approximately fifty patients with fibro-cavernous pulmonary tuberculosis have been subjected to thoracoplasty at the Austin Hospital. The results have been very encouraging and have prompted us to present this brief review of the general principles of the operation and of the problems concerned in the selection of suitable cases. We also desire to present an analysis of the results so far obtained in this series.

General Principles of Operation.

The immediate aim of all methods of collapse therapy is to reduce the volume of the lung, or of part of the lung, sufficiently to allow the closure of pulmonary cavities and the healing of tuberculous lesions. If it is admitted that collapse is necessary, the method used should be capable of producing a sufficient degree of collapse to obtain the desired result. Tuberculous lesions which eventually require thoracoplasty usually call for an extensive reduction of the volume of lung, at least in the affected area. Brauer in 1909 expressed the aphorism "the better the pulmonary collapse, the better the clinical result", which is a principle long recognized in therapy by artificial pneumothorax.

[1] The article is the text of a lecture delivered on March 18, 1939, during the twelfth annual general meeting of the Royal Australasian College of Surgeons. The lecture comprises certain sections of a review presented by Dr. A. M. Hutson and Dr. J. F. Hughes as the holders of the Syme Research Scholarship for 1938. Accepted for publication on April 15, 1939.

Even a total and extensive thoracoplasty cannot produce the same degree of collapse as can be obtained with a complete pneumothorax, but fairly complete collapse of either the upper part alone or of the whole of the lung can be produced by rib resection planned to conform with certain essential principles.

In 1895 Gourdet showed that if extensive collapse of the chest wall was desired, the removal of the posterior portions of the ribs, including the angle, was much more effective than the resection of greater lengths of rib anteriorly or in the axilla. Unless this posterior arc of the rib is resected, very little

FIGURE I. Illustrating the small reduction in size of the apical area when the first rib was inadvertently left intact at a first-stage operation.

collapse of that portion of the lung occupying the mediastino-vertebral angle will be obtained.

Wilms and Sauerbruch early realized that some mobilization of the first rib was essential. Very little collapse of the apical region will be obtained unless the first rib is at least partly resected. Collapse of the lower portions of the thoracic wall is also limited unless the first rib is mobilized, since the whole thorax is to some extent suspended from the arc of this rib ("coat-hanger effect"). Figure I illustrates the small reduction in size of the apical area when the first rib was inadvertently left at a first-stage operation. This may be contrasted with Figures IIA and IIB, which show the degree of collapse obtained with the resection of the upper three ribs.

In a Sauerbruch paravertebral thoracoplasty only a small portion of the first rib is resected posteriorly. If complete collapse of the apical region is desired, almost the whole of the first rib must be removed, and, since most cavities are apical in position, this is very frequently necessary. In the early cases of this series only a small segment of the first rib was removed, but in the past few years it has been the routine custom to remove as much

of this rib as possible, with a corresponding increase in the collapse of the apical zone (see Figures IIA and IIB).

Number of Ribs to be Resected.

Sauerbruch has insisted that if collapse is to be effective, parts of at least ten and preferably eleven ribs, including the first, should be resected. He pointed out that the arc of the tenth rib was important in keeping the diaphragm under tension. If this rib was removed the diaphragm was relaxed

FIGURE IIA. Showing cavity at apex of lung before operation.

FIGURE IIB. Showing the reduction in size of the apex following the resection of the upper three ribs. Note reduction of the size of the cavity.

and could rise into the thoracic cavity, so increasing the collapse. In general he was opposed to partial operations. It was gradually recognized by many surgeons, however, that a satisfactory result could be obtained with upper lobe lesions by the resection of sufficient lengths of the upper ribs. Straub recommended partial operations in a number of cases, but pointed out that at least seven or eight ribs should be resected to allow depression of the scapula to increase collapse of the involved area. Partial upper or apical thoracoplasty has now been almost universally accepted as the standard procedure for lesions occupying the upper lobe alone.

It should be noted that the level of the clavicle in standard postero-anterior skiagrams corresponds to the angle of the fourth or even the fifth rib posteriorly (see Figure III). Therefore, owing to the oblique course of the upper rib, a cavity which is completely above the level of the clavicle cannot usually be closed unless at least four or five ribs are resected. In addition, following the removal of the uppermost ribs the cavity usually descends downwards and medially, and therefore the sixth or seventh ribs

may also require resection to obtain complete collapse of the region of the cavity. For most patients, therefore, the resection of at least the upper seven ribs is usually necessary.

For cavitation restricted to the lower lobe, it is still necessary to resect the upper ribs. Resection of the lower ribs alone cannot usually be successful because the rigid arcs of the ribs above would prevent adequate collapse of

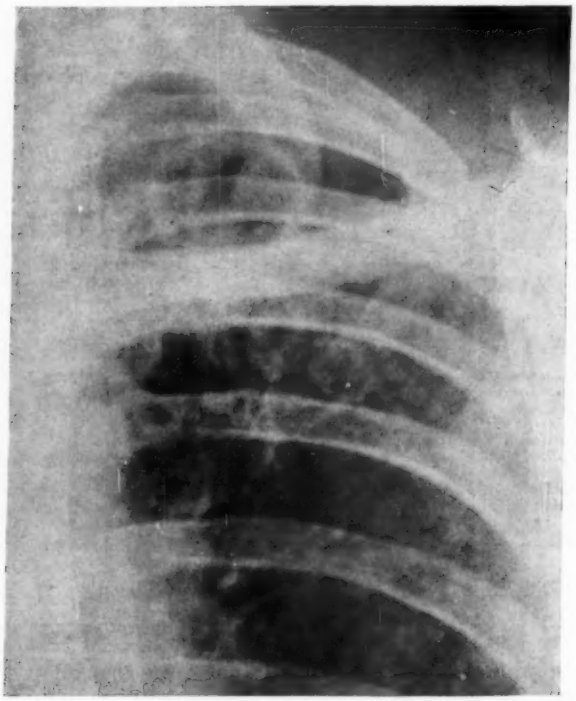

FIGURE III. A cavity completely above the level of the clavicle. The lower margin of the cavity extends below the level of the angle of the fourth rib.

the basal region. As a general rule, it is necessary that the resection include all ribs above the level of the lesions, and since these are displaced downwards following the removal of the upper ribs, the resection should also include one or two ribs below the original level.

In this series the majority of patients have had operations involving the partial resection of nine, ten or eleven ribs. In many recent cases partial operations, including the upper seven ribs, have been performed. Figures IVA and IVB illustrate the general appearance of the chest after this procedure. It will be noted that a considerable proportion of the lower lobe is still available for respiratory function.

Length of Ribs to be Resected and Number of Operative Stages.

In the standard paravertebral thoracoplasty of Wilms and Sauerbruch short lengths only of the posterior portions of the first ten or eleven ribs are resected, in one or two operative stages. This procedure is open to the objection that successful closure of the cavities is not obtained in a considerable percentage of cases. Brauer consequently advocated his paravertebral subscapular thoracoplasty, in which greater lengths of the upper ribs beneath the scapula were resected in the attempt to produce more efficient apical collapse and consequently an increased percentage of favourable results. The success attending this type of operation led a number

FIGURE IVA. Showing fibro-cavernous lesion in the upper lobe of the left lung before operation.

FIGURE IVB. Illustrating the general appearance of the chest after a partial (seven-rib) thoracoplasty for a fibro-cavernous lesion in the upper lobe of the left lung.

of surgeons to remove even greater lengths of the uppermost ribs, particularly when dealing with large cavities in the upper lobe. Alexander, in 1928, and later O'Brien, recommended the resection of practically the whole of the first rib, of the second rib almost to its cartilage, and the third to seventh ribs as far forward as is indicated according to the size and position of the cavity in the individual case. Resection of the lower ribs is performed only if the lesions extend to the lower lobe. With this technique they claim that it is possible to close the majority of even very large cavities in the upper lobe.

While the Sauerbruch operation is undoubtedly effective in many cases, it has been superseded by the above type of operation in most clinics. The technique outlined above represents a natural development of the original operation and has the distinct advantage that the extent of the procedure can be planned in each case to correspond with individual requirements.

Even if the posterior segments of the ribs are resected as far medially as the transverse processes, there still remains a considerable volume of lung in the costo-vertebral sulcus which will not be affected by the resulting

collapse. Since cavities are frequently situated in this part of the lung, many surgeons have attempted to reduce the volume of this sulcus by resecting the whole or parts of the overlying transverse processes. Alexander states that he now resects the processes and the underlying sections of ribs in the majority of his cases. This procedure apparently does not lead to any increase in the frequency of post-operative scoliosis.

There has always been considerable difference of opinion regarding the number of operative stages that are advisable with an extensive thoracoplasty. The trend in recent years has been to perform operation in multiple stages, and the risks of the procedure have been in consequence much reduced. Hedblom, in particular, stressed the importance of many stages in the operation, and pointed out that the resection of greater lengths of ribs was then possible without increasing the ultimate danger of the operation.

If the chest wall is extensively and suddenly mobilized, the main danger is that severe paradoxical and pendulum respiration will occur and cause death from cardio-respiratory failure. If only a limited number of ribs are resected at each operative stage, the chest wall will, by the organization of exudate and the proliferation of periosteum, regain a considerable degree of rigidity and enable further ribs to be resected with much more safety.

In addition, collapse of the lung is produced more slowly and there is consequently less risk of a sudden flooding of the normal lung by infected secretions forced from the collapsed diseased area.

If considerable lengths of rib are to be resected as in the modern operation, staging of the procedure is almost essential. Alexander emphasizes that this is one of the basic principles of the modern operation. He recommends that as a rule no more than three ribs be resected at each operative stage. A thoracoplasty involving seven or eight ribs may then require at least three operative stages.

Time Interval between Stages.

As a general rule, an interval of two to four weeks between stages is the optimum for most patients. During this period the wound should have firmly healed and the patient have recovered from any post-operative disturbance. The area of the thoracic wall originally mobilized will usually have recovered sufficient rigidity to prevent the development of excessive paradoxical movement at the next stage. Complications, either in the wound or in the lung, may delay the performance of the next operation. Should this interval be too long, regeneration of ribs may prevent the maximum degree of collapse being obtained with further resections.

This is one of the technical disadvantages of the staged operation, and in the past few years many surgeons have attempted to prevent or delay costal regeneration. Originally, Zenker's solution was used to delay the osteogenic activity of the periosteum, but in recent years a 10% solution of formalin has been found most useful for this purpose. Very little regeneration occurs after the use of formalin, and delay in the performance of the next operative stage does not assume much importance. Alexander states that formalin should be used for posterior portions of the upper ribs and for those segments of ribs underlying the rigid scapula. The lateral and anterior portions of the periosteal sheaths are not treated, so that

regeneration in these areas will restore the rigidity of the chest wall. This procedure has not, so far, been adopted at the Austin Hospital.

The Ribs to be Resected at the First Stage.

Sauerbruch, Archibald and others have always preferred to resect the lower ribs, and to produce collapse of the base of the lung as the first stage in the performance of a thoracoplasty. They believed that the liability to post-operative aspiration pneumonia was reduced by the preliminary collapse of the lower lung. Despite this contention, a careful review of the operative mortality showed that aspiration pneumonia was the most frequent complication of the operation, and that it appeared to be even more frequent after the lower than the upper stages of the operation.

Several surgeons then recommended that the upper rib be resected first, and it was found that pneumonic complications were actually less frequent and that the general results were very satisfactory.

Since most large cavities are in the upper lobe, collapse of the most affected area is caused first, and there is frequently a considerable reduction in the amount of sputum before the next stage is performed. Although removal of the upper ribs produces a relatively great collapse of the apical region, the post-operative reaction is slight because that area of the thoracic wall is stabilized by the scapula and muscles of the shoulder girdle. In addition, the function of coughing is much less disturbed with upper than lower stage operations, and Alexander emphasizes that this is the important factor in the prevention of spread by aspiration. If the major lesions are controlled first and sputum is reduced, the reduction in the efficiency in coughing following the mobilization of the lower ribs does not assume much importance.

During the last ten years primary resection of the upper ribs has gradually become the standard procedure in many clinics. Accompanying this change in technique, the operation of partial upper thoracoplasty, in which the resections are restricted to the upper ribs, has also been recognized as a valuable procedure. This is an important development because excellent results can be obtained with this more conservative operation in suitable cases.

In this series of cases there has been a gradual evolution in the technique used, corresponding approximately with the developments outlined above.

In the early cases relatively short lengths of four or five ribs were resected at each stage. Operation was usually begun at the tenth or eleventh rib and completed in three stages. Figure V illustrates the present condition of the chest in the first patient in this series. The operation was performed in March, 1931, and the skiagram was taken in January, 1939. It will be seen that only a small portion of the first rib was resected and short lengths of the second to eleventh ribs. The clinical result is excellent.

Partly as an experiment, the upper ribs were resected first in two cases during 1933-1934, with satisfactory results. Following this, various operations were performed by each method in an attempt to assess their relative value. Although no definite conclusions can be reached, the present preference is for the upper stage as the first operation, particularly for those cases in which it appears that only a partial operation may be necessary.

During the last three years it has also been the practice to resect much greater lengths of rib, particularly in the region of the lesion. At the present time the first rib is removed almost completely and the second and third as far forward as is possible through a posterior incision. Technically it may be difficult to reach the anterior portion of the second and third ribs through this incision, even if the scapula is well retracted. At the second stage after the resection of the fourth and fifth ribs, it is usually possible to resect further portions of the anterior stumps of the second and third ribs if necessary.

In some cases collapse of the apex remains incomplete, despite the resection of such lengths of rib. In these, small subsidiary anterior operations involving the resection of the anterior stumps of the second and third ribs have been done. We have not adopted any extensive anterior procedure involving the division or resection of the costal cartilages *et cetera,* but with large apical cavities this would be a rational procedure.

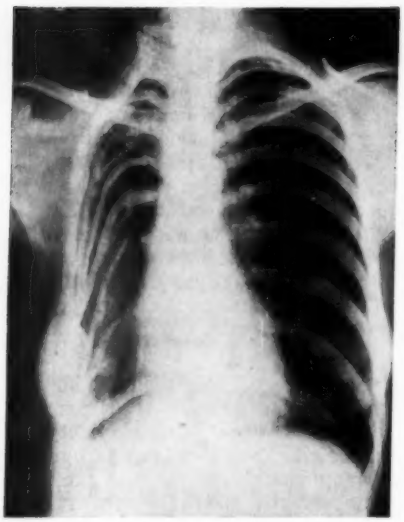

FIGURE V. Illustrating the type of operation performed in the first patient of this series in March, 1931. Only short posterior sections of the ribs were resected. Skiagram taken in January, 1939.

It has been found that if great lengths of rib are to be resected, a smoother post-operative course results if each operation is restricted to a small number of ribs. In general, no more than the upper three ribs are dealt with in the first stage, and no more than four at each subsequent operation. The surgeon may be guided, however, by the thickness and rigidity of the pleura which is exposed during operation. If this is firm and no paradoxical movement is apparent, it may be justifiable to resect further ribs if the general condition of the patient permits. On the other hand, the development of any degree of paradoxical movement is usually an indication to terminate the operation.

The upper ribs were resected first in each of the last twelve patients operated upon during 1938. Only two patients were subjected to a complete operation with resection of eleven ribs. Six patients have had partial operations involving the upper six or seven ribs, and although it is too early to assess the results, it appears probable that all will be successful.

Summary.

To obtain satisfactory pulmonary collapse with thoracoplasty the rib resections should be performed posteriorly and extend medially at least to the transverse processes. The resection of the processes and of the underlying section of rib will considerably increase the collapse of that part of the lung underlying the costo-vertebral sulcus.

Since most cavities are in the upper lobe, collapse should be most complete in this region, consequently relatively great lengths of the upper ribs should be resected. In all cases some mobilization of the first rib is essential, and if the whole rib is resected the collapse of the apical area will be much more effective. The extent of the resection necessary in the lower ribs is determined by the condition of the lung in the individual case. In suitable cases, operations restricted to the upper ribs may give very satisfactory results.

The safety of thoracoplasty is much increased if it is performed in multiple stages, with an optimum interval of two to four weeks between each operation.

THE INDICATIONS FOR THORACOPLASTY.

Thoracoplasty is chiefly indicated for the patient with unilateral chronic tuberculosis of the fibrotic type, in whom the pulmonary cavities cannot be closed by any available simpler method.

The type and extent of the disease are important in the assessment of both the probability of success and the operative risk. Experience has shown that the procedure is most successful in those cases in which the lesions are mainly productive and fibrotic in type, and has also demonstrated the danger of operation in the presence of acute exudative foci. Archibald has pointed out:

> It may be laid down as a safe procedure that the patient who shows no evidence of fibrosis, whose history demonstrates the tendency to activity, and whose lesions are at the moment active, even though the disease be strictly unilateral, should not be operated upon, because the undoubted strain of operation is very likely to aggravate the disease, since Nature contributes nothing in the way of help.

In other words, the lesions should have progressed to the stage of healing, when exudative elements are mainly replaced by proliferating fibrous tissue. Although the demarcation between these phases is not rigid, the history of the patient and the skiagraphic appearances are usually sufficient to enable a clinical distinction to be made.

The general course of the disease and the appearance of the lesions in serial skiagrams should be reviewed and considered in association with the temperature chart and serial blood sedimentation tests. Thoracoplasty should not be performed if there has been a recent increase in the constitutional phenomena or any increase in the usual degree of fever, particularly if the skiagrams show that there has been any increase in the size of the lesions or the development of new foci.

A history of repeated hæmoptyses strengthens the indications for operation if the conditions are otherwise suitable. Thoracoplasty should rarely be used actually during the period of hæmorrhage. The occurrence of periodic exacerbation of symptoms, associated with an acute febrile reaction, may often be an indication for operation, even though the patient may be in apparently good health between successive attacks.

Although the aim of treatment is to free the patient of infected sputum, the amount of sputum present is not in itself an indication for or against operation. If expectoration is excessive, additional care is necessary before and after operation to diminish the risk of spread by aspiration. In patients with purely productive lesions, although there may be only a little sputum, it may be heavily loaded with tubercle bacilli and operation will be indicated to close the cavity and check the slow progression of disease.

In an ideal case the lung on the opposite side should show no evidence of tuberculous lesions. In practice this is rarely found, however, for if the lesions on the involved side have progressed to the stage when thoracoplasty is necessary, the relatively normal lung usually shows some evidence of past infection. The presence of some fibrous scarring or several small encapsulated or calcified nodules in the upper lobe does not contraindicate operation. On the other hand, a small recent focus in this situation may be a source of danger and lead to extensive spread following the stress of operation. For this reason, if any lesions are visible, they should be carefully compared with those seen in previous films, and, if necessary, operation should be delayed until their evolution can be studied. If they are stationary or retrogressive over a period of months, thoracoplasty should be reasonably safe.

In several of our cases there has been moderately extensive disease in the opposite lung when the patient was first seen. Under observation these lesions have either resolved or become firmly encapsulated, even though the cavities in the more extensively diseased lung have increased in size. Apparently patients with bilateral lesions have therefore become quite suitable subjects for thoracoplasty.

Considerable experience is necessary to decide whether in any given case the amount of disease in the contralateral lung is sufficient to contraindicate operation. In recent years the trend in many clinics has been to allow operation in more advanced cases than was previously considered safe. Cavitation in this lung, however, remains almost an absolute contraindication. If the cavity is very small, stationary in size and situated in the extreme apical zone, operation may be permissible in special circumstances. In any case it is agreed that the danger of operation in the presence of bilateral lesions is much increased, and in these circumstances it is imperative that thoracoplasty should be recommended only if the lesions have been quiescent for many months or even years.

The sound lung should also be free of other respiratory disease which may adversely affect its function. The presence of chronic bronchitis, extensive emphysema or a history of bronchial asthma should therefore make operation inadvisable. Thoracoplasty should not be performed in the presence of an excessively mobile mediastinum because of the danger of severe paradoxical movement following operation.

Some tuberculous infiltration of the larynx is present in many patients who are under consideration for thoracoplasty. If the ulceration is not extensive and the laryngeal symptoms do not dominate the clinical picture, the reduction of the toxæmia and the amount of sputum following operation may allow the larynx to heal. In a doubtful case, then, the development of laryngitis may be an additional indication for operation. Advanced and destructive disease forms a definite contraindication.

Established tuberculous enteritis, amyloid disease or progressive tuberculosis on the bones, joints or renal tract are unfavourable complications which as a rule exclude the possibility of thoracoplasty.

The general condition of the patient is the most important factor to be considered in assessing the probable risk of thoracoplasty. A patient should not be considered a suitable subject for this operation if he does not

appear to be in a condition to stand other major surgical procedures. Thoracoplasty should not be advocated as a last resort in the face of rapidly advancing or apparently hopeless disease. The patient must possess an adequate cardio-respiratory reserve, to be able to tolerate both the stress of an extensive operation and the lowering of his vital capacity by pulmonary collapse. The presence of even slight dyspnœa should contraindicate operation, except in those patients in whom dyspnœa is due to distortion of the trachea and mediastinum.

In common with most surgical procedures, the operative risk is increased after middle life because of the impaired cardio-respiratory reserve. This particularly applies to tuberculous patients who have been subject to long-continued mild toxæmia. Although there are no definite age limits, few patients should be operated upon after the fourth decade. In this series several patients were over forty and the average age was about thirty years.

There has been considerable discussion concerning the most favourable time to recommend thoracoplasty. Sauerbruch does not advise the operation unless the lesions are at least two years old. Alexander states that thoracoplasty should be performed without regard to the age of the lesions, as soon as the indications are clear. Morriston Davies suggests that every "unilateral case of tuberculosis should be regarded from the time it is first seen as a potential case for thoracoplasty". In addition, he suggests that patients whose condition is mainly unilateral, but who have a localized upper lobe lesion in the opposite lung, should be observed from this point of view because such a lesion may fibrose and allow the major operation to be done later on the seriously affected side. If collapse in therapy is necessary for these cases, that is, if cavitation appears, the procedures are tried in sequence, and thoracoplasty is recommended as soon as the failure of other methods is apparent.

In the present series the average duration of known disease before operation was four years. In some cases the disease had progressed to the stage of fibrosis and cavitation when the patient was first seen, and in these operation was recommended as soon as it could be demonstrated that the lesions were not extending. In patients initially presenting acute or bilateral lesions, the course of the disease was closely followed for several months or years and operation performed at a favourable quiescent period.

Special Indications.

Tuberculous Empyema.—Thoracoplasty is frequently indicated to close the residual cavity in chronic tuberculous empyema, either in cases arising spontaneously or in those complicating an induced pneumothorax.

The condition of the patient with this most severe complication of pulmonary tuberculosis is very variable and depends largely on the extent of the underlying pulmonary infection. In addition, the empyema may be complicated by the development of a broncho-pleural fistula and consequent pyogenic infection. No definite rules of treatment can be formulated, and each case must be treated as an individual problem.

In two of the early cases in this series a pyopneumothorax was treated by frequent repeated aspirations until the residual cavity was reasonably small, and then an extensive extrapleural thoracoplasty was performed to

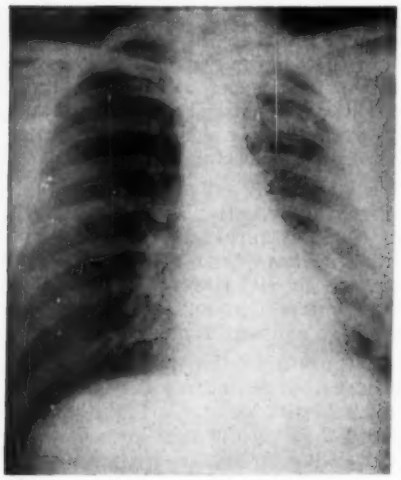

FIGURE VIA. Fibro-caseous disease, with cavitation, involving both lobes of the left lung.

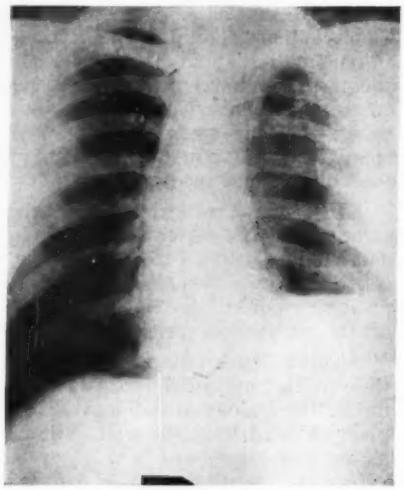

FIGURE VIB. A pneumothorax was induced and was complicated by the rapid development of a purulent effusion. This was aspirated frequently and the pleural cavity kept as dry as possible. A left phrenic section was performed six months after the induction of the pneumothorax. Four months later an extensive thoracoplasty, including eleven ribs, was completed in three stages.

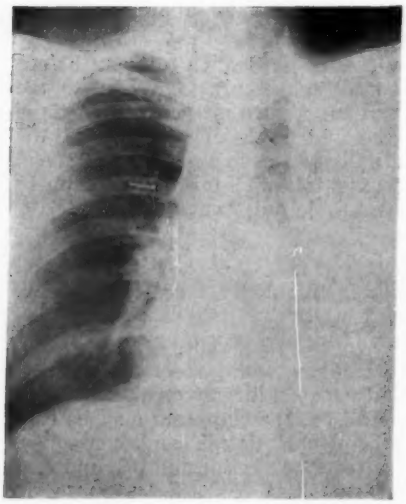

FIGURE VIC. Showing condition twelve months after the completion of thoracoplasty. The patient has remained well and at work for four years.

bring the pleural layers into apposition. The skiagrams in Figures VIA, VIB and VIC illustrate the successful results obtained in one of these patients.

In recent years the general procedure has been to commence treatment by aspiration and replacement of the pus with a solution of "Metaphen", 1 in 5,000, with 2% gelatine in normal solution, as described by Ferguson, Penington and Watson. The empyema may occasionally be rendered sterile by this method alone.

If pus continues to form, continuous negative pressure is used to reduce the size of the residual cavity as far as possible. Thoracoplasty should then be performed if the general condition of the patient is otherwise favourable. Negative pressure drainage may be continued

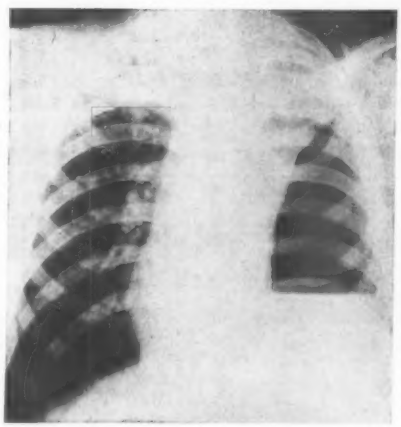

FIGURE VIIA. Large pyopneumothorax, with displacement of the mediastinum to the right. Several small cavities are visible in the left upper lobe. The effusion was aspirated on frequent occasions, for several months, and then an eleven-rib thoracoplasty was completed in three stages.

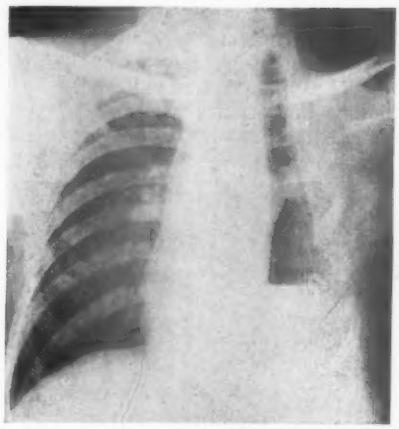

FIGURE VIIB. Three months after the operation the empyema cavity is much smaller, but pus and air are both present. Continuous suction drainage was instituted and continued for eight months. The empyema cavity was slowly obliterated and the lung reexpanded. The patient has remained well and the fibrotic nodules in the right lung have been stationary for two years.

during and after the period of operation and until the cavity is completely obliterated.

The skiagrams in Figures VIIA, VIIB and VIIC illustrate the condition of the chest in a patient whose mixed tuberculous and pyogenic empyema was obliterated by this method.

Extreme Fibrosis.—In some advanced cases of fibroid phthisis the extreme fibrosis and retraction of the involved lung may produce considerable displacement and distortion of the trachea and other mediastinal structures. Fibrous tissue may almost completely replace the shrunken lung, and dyspnœa, wheezing and cyanosis may result from mechanical distortion. In these cases, cavities, if present, may be only very small, but a partial upper thoracoplasty may be indicated to reduce the tension and distortion of the mediastinum, and afford considerable symptomatic relief.

FIGURE VIIC. Potter-Bucky skiagram of the left lung taken two years later. The lung has expanded and no cavities are visible.

Summary.

Thoracoplasty is chiefly indicated to close tuberculous pulmonary cavities which have resisted other available forms of treatment.

The operation should only be performed in a quiescent phase of the disease in patients who are in fairly good general condition and who have an adequate cardio-respiratory reserve.

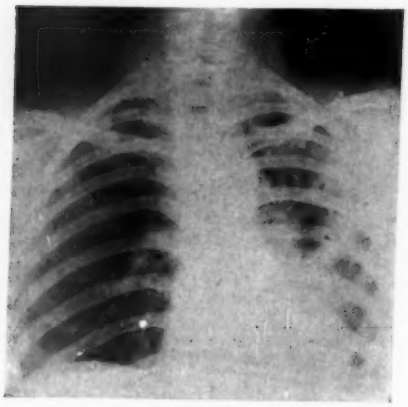

FIGURE VIIIA. Large cavity in the middle zone of the left lung, with considerable surrounding infiltration.

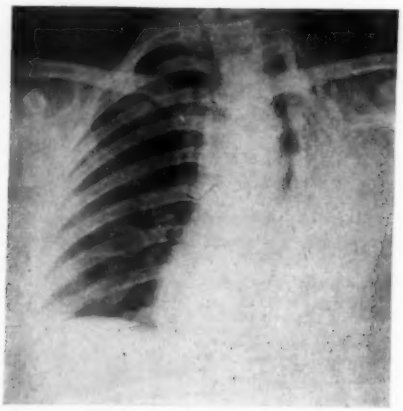

FIGURE VIIIB. The cavity has been obliterated by a postero-lateral thoracoplasty involving eleven ribs.

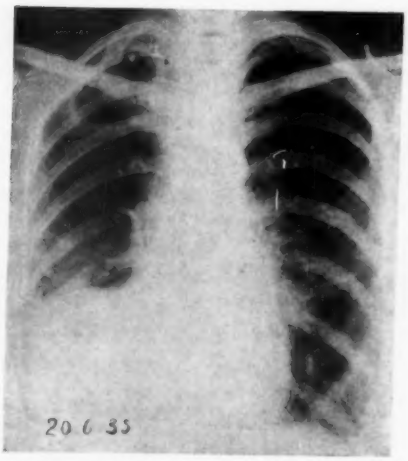

FIGURE IXA. Showing very large cavity in the upper lobe of the right lung.

FIGURE IXB. After a postero-lateral thoracoplasty including six ribs, the cavity has been greatly reduced in size, but is still visible as a "slit". The left lung has remained clear. This patient still has sputum positive for tubercle bacilli.

The lesions should be mainly unilateral and predominantly proliferative in type, and should have reached the stage at which some attempt at natural healing is evident.

Operation is contraindicated if there are new or active lesions in the opposite lung or other organs. In addition, the contralateral lung should be free of other respiratory disease which may reduce its function. Extensive ulceration of the larynx, amyloid disease and established tuberculous enteritis are important contraindications.

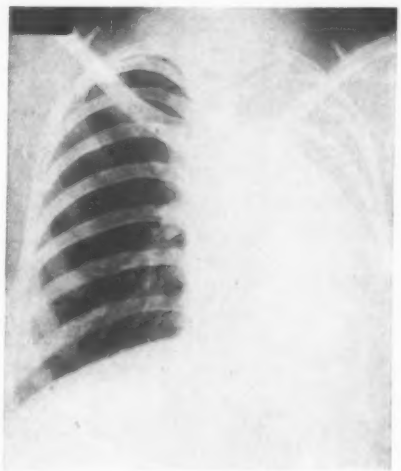

FIGURE Xa. Extensive fibrosis and pleural thickening in the left lung of a woman, aged twenty years. Previous films had shown extensive tuberculous infiltration and cavitation following on pneumonia two years before. Note the distortion of the trachea and the displacement of the mediastinum to the left.

FIGURE Xb. A standard skiagram showing that the right lung had remained clear two years after the completion of a postero-lateral thoracoplasty.

Thoracoplasty may also be used to relieve the symptoms of excessive mediastinal displacement and to close the residual cavity of a chronic tuberculous empyema.

The accompanying skiagrams in Figures VIIIa, VIIIb, IXa, IXb, Xa, Xb and Xc illustrate the typical examples of the type of lesion present in patients in this series subjected to thoracoplasty.

GENERAL SURVEY OF THE RESULTS OF THORACOPLASTY IN FORTY-SEVEN PATIENTS.

During the eight-year period 1931-1938 inclusive, forty-seven patients were subjected to thoracoplasty at the Austin Hospital. In forty patients the indication for operation was fibro-caseous pulmonary tuberculosis, in which other available methods had failed to control the disease. In the remaining seven cases the pulmonary lesions were complicated by the presence of a tuberculous empyema.

In this series there were twenty males and twenty-seven females, the average age being thirty-one years. The age groups are shown in Table I.

FIGURE Xc. Potter-Bucky skiagram of the left side of the chest showing the very complete collapse of the hemithorax obtained in this case. The patient has been free of symptoms and at work for nearly two years.

In thirty-one patients the operation involved the left side of the thorax, and in sixteen the right side. The average duration of known disease before operation was four years.

Altogether 115 operations were performed, not including phrenic nerve section and other subsidiary minor procedures. In the majority of patients a complete thoracoplasty, involving the resection of nine, ten or eleven ribs, was performed, usually in three stages. In many of the more recent cases the resections have been limited to the upper ribs—the so-called "apical" thoracoplasty. In these cases also two or three stages were used. In addition, five patients have had subsidiary anterior or axillary operations.

Seven patients died as a result of operation, representing a mortality rate of 15%. Considered on the basis of the total of 115 operations, the mortality rate per operative stage was 6%. A further six deaths occurred from gradual progression or recurrence of the tuberculous lesions at varying periods up to two years after operation, that is, the mortality since operation has been 12·6%. During the eight-year period, therefore, thirteen patients have died, the total mortality being 27·6%.

Since in many patients tuberculosis is such a chronic, slowly progressive disease, at least two years must elapse before it is possible to estimate the value of any mode of treatment. It is rarely justifiable to claim cure, and probably five years of good health should be the minimum period necessary before even "clinical" cure can be claimed.

A complete analysis of the results cannot therefore be given at the present time because nineteen of our patients have been operated upon during the past two years. A general survey, however, shows that on the whole the results have been very encouraging.

TABLE I.
Showing the Age Groups of the Forty-seven Cases.

Age at Time of Operation.	Male.	Female.	Total.
11 to 20 years	—	2	2
21 to 30 years	7	8	15
31 to 40 years	10	15	25
41 to 50 years	3	2	5
Over 50 years	—	—	—
Total	20	27	47

Thirty-four patients are still living, and Table II shows that, of these, twenty-four have either no sputum or residual sputum which is microscopically "negative" for tubercle bacilli. That is, 70% of those living have been rendered apparently non-infective.

TABLE II.

Showing the Period of Survival, and Present Status of the Thirty-four Living Patients in this Series.

Time of Survival.	Number.	Number with No Sputum or Sputum "Negative" for Tubercle Bacilli.	Number with Positive Sputum.	Number Capable of Work.
Over 4 and up to 8 years	7	4	3	4
Over 2 and up to 4 years	14	10	4	10
Over 1 and up to 2 years	5	3	2	3
Over 6 months and up to 1 year	8	7	1	1
Total	34	24	10	18

These patients all had persistently "negative" sputum on discharge from hospital and have been reexamined at intervals since. All except three have been examined during the past few months. In view of the unreliability of occasional microscopic examinations in patients with a small amount of residual sputum, we intend to check these results by culture of the sputum on Petrognagni's medium. For practical purposes, however, these figures can be used, and they compare very favourably with the results obtained by other methods of treatment. For example, in an analysis of 600 patients treated by artificial pneumothorax, Matson, Matson and Bisaillon showed that if the pneumothorax was satisfactory, 48% of the patients became clinically well. On the other hand, if the pneumothorax was incomplete, only 11% became well.

Ten patients still have variable, but mostly small, amounts of sputum containing tubercle bacilli. The aim of modern collapse therapy has not been achieved in these patients, and they are still exposed to the menace of possible spread of the disease. Strictly, the operations should be classed as surgical failures, in that closure of the pulmonary cavities has not been obtained. On the other hand, most of the patients are considerably improved in general health following the operation and express the opinion that the procedure has been worth while.

Of the thirty-four patients, eighteen have already returned to their normal duties or are able to carry on some suitable occupation. Most of the women have returned to full domestic or clerical duties, and the men are engaged in a variety of occupations, mainly clerical or of a light manual type. Several have now been working for over four years, and appear to be in excellent health and quite able to play a normal part in the social and economic life of the community.

The only true conception of the health of a patient is derived from observations of, or a knowledge of, his capacity to work, and of the feeling of well-being which he enjoys in recreation in his own environment. It is difficult to demonstrate this for statistical purposes or for publication, but

the majority of our patients who have returned to work are fully convinced that they are quite well, some stating that they had never previously been in better health.

Only one patient remains unimproved by the operation. In this case a sinus has persisted after a complete thoracoplasty for tuberculous empyema, and amyloid disease has gradually developed. With this exception, all patients who were not improved by operation have since died.

Of those patients who have improved sufficiently in health to be discharged from hospital, only one has so far died; in this instance death was due to spread of tuberculosis in the previously normal lung, and this occurred after nearly two years of apparently good health. Since in two of the very early cases the patients have remained in very good health for seven or eight years, and no others have relapsed, I am encouraged to hope that the satisfactory results of the operation will be maintained.

Summary.

During the eight-year period 1931-1938 inclusive, forty-seven patients were subjected to thoracoplasty at the Austin Hospital. Of these, thirty-four are still living and thirteen have died. Seven deaths were directly attributed to the operation and six to the eventual progression of the disease. The immediate mortality due to the operation was therefore 15%, and the total mortality over the eight-year period 27·6%.

Of the surviving patients, twenty-four have either no sputum or residual sputum microscopically "negative" for tubercle bacilli.

Of these, eighteen are able to carry on their normal, or some suitable, occupation, three have been working and free of symptoms for over five years, and may be classed as "clinically cured"; a further ten have been well for over two years and appear to be maintaining their general health.

A brief statistical summary of the results is shown in Tables III and IV.

TABLE III.

General Survey of the Results of Thoracoplasty in Forty-seven Patients during the Eight-year Period 1931–1938.

Observation.	Number.	Percentage.
Number of operative deaths	7	15·0
Number of deaths since operation	6	12·6
Total number of deaths	13	27·6
Total number of patients still living ..	34	72·4

TABLE IV.

Present Status of the Living Patients among Forty-seven subjected to Thoracoplasty during the Eight-year Period 1931–1938.

Observation.	Number.	Percentage.
Improved in health	33	97·0
Unimproved	1	3·0
Sputum positive for tubercle bacilli ..	10	29·4
Sputum "negative" for tubercle bacilli ..	24	70·6
Well and capable of work	18	53·0

ACKNOWLEDGEMENTS.

We desire to express our thanks to Mr. H. C. Trumble and Dr. J. Bell Ferguson for their kindness in allowing us to present this review of the patients who have been under their care.

The general management of the patients has been carried out under the careful direction of Dr. Bell Ferguson, and the surgical treatment has been performed mainly by Mr. Trumble, whose skill and enthusiasm are responsible for the excellent results obtained in so many patients.

We also desire to express our thanks to Mr. E. S. J. King for his valuable advice and criticism during the preparation of this paper.

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RECENT THOUGHTS ON ORTHOPTICS.[1]

By J. Bruce Hamilton,
Hobart.

I am a little diffident about the remarks I have been asked to make because I realize they are a trifle ethereal, but I have recently become air-minded, which accounts for their nature. I should like to divide my comments into three groups, and the first question I shall deal with is eye strain due to insufficiency of convergence and of accommodation.

Convergence and Accommodation Insufficiencies.

There are none of us too young to remember the day when the family physician almost as a routine prescribed medicine and good advice. A full investigation of most diseases was impossible and frequently unattempted, but fortunately for man the day of the lone bottle of medicine has more or less vanished. Patients are subjected to more thorough examination, the relevant facts are selected, and finally a provisional diagnosis is made. Ophthalmology also had a similar setting. In our case the bottle of medicine was supplanted by a pair of spectacles, and, I regret to say, very scant attention was sometimes paid to other important structures, and especially to the intraocular and extraocular muscles. Recently oculists have realized that not only may the intraocular, but also extraocular, muscles be subjected to over-strain, or may be the seat of acquired weakness, and so cause ocular or cephalic pain. To correct errors of refraction without attention to the intraocular and extraocular musculature is decidedly unsatisfactory. Let me say at once that I am not for a moment advocating the disregard of refractive error, such as Stutterheim (1937) has recently suggested. In every case of muscle imbalance I feel certain that an estimation of the refraction under mydriatic is essential, and all moderate and large errors should be corrected; but I am referring to muscular imbalance or convergence and accommodation defects which remain unattended, while a quarter of a diopter of astigmatism is corrected with a flourish (Byrne, 1934).

I quite realize that we are yet very ignorant of the mechanism of many of the ocular imbalances, and that our methods of correction are far from perfect, but I do submit that we are progressing slowly towards the goal which should be perfect control of all cases of muscular imbalance. According to one American authority, we are using our eyes 170% more than we were forty years ago. It is only to be expected, therefore, that eyes which are taxed excessively will often—especially in debilitated conditions of the body—show signs of fatigue, and symptoms of asthenopia supervene. It has been admitted for some years that the intraocular muscles play a very definite part in the symptoms of asthenopia, but for some apparent reason extraocular

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muscles have been ignored and neglected in many cases, and have not been allotted their rightful role in the production of eye strain.

Stutterheim, in his recent book on "Eyestrain and Convergence" (1937), has again drawn our attention to the fact that weak convergence is frequently a cause of eye strain. I do not entirely agree with his technique, nor do I think his apparatus at all impressive. Nevertheless, I do feel that his objective is right, and I believe that if every patient who has muscular imbalance or eye strain, but no refractive error, were submitted to a full orthoptic examination, we should rapidly acquire most valuable information, both for diagnosis and treatment. I do not think that our present consulting-room method of Maddox rod and wing, Worth's 4-dot, subjective and objective convergence and *punctum proximum* tests is sufficient in doubtful cases, and daily I glean most interesting information in suspicious cases from referring patients for orthoptic diagnosis.

For instance, a girl whom I had had under observation for eye strain for four years recently reported again, complaining that she had been unable to proceed with her university study. Her refraction was absolutely normal, except for one prism diopter of exophoria for distance, and five for near; and she had a subjective convergence to 15 millimetres. I did find that she had inability to dissociate her convergence from her accommodation (at six metres) beyond base-out prisms of eight diopters. On orthoptic examination adduction limited to 15 prism diopters was revealed, and after seven exercises she had 110 prism diopters of adduction, and a further five exercises were devoted to dissociation of her convergence and accommodation. She reported to me after twelve exercises, completely comfortable, with no exophoria for distance and two prism diopters for near. Her subject convergence stood at 10 centimetres, and she had 16 prism diopters convergence reserve at six metres. She is now able to continue with her university studies, and certainly seems to have benefited greatly by the exercises.

On previous occasions I was unable in this case to procure relief of symptoms. Some might say that the result was purely psychological, but this is only one of over 20 such cases in which relief has been afforded, and the blunt fact of the matter is that the patient was unable to pursue her studies when she first reported and now has no fatigue with continuous close work.

But let me return to the work of Stutterheim. From experience we know that patients who cannot dissociate their accommodation from their convergence and who possess large refractive errors frequently acquire an esotropia or an exotropia. Stutterheim is a strong advocate of prism convergence in all cases of asthenopia, but the methods he employs seem to be rather indefinite in purpose and to involve full stimulation of the convergence and only partial stimulation of accommodation. Maddox (1907) points out that the correct method of stimulating convergence and dissociating it from accommodation is to make the patient fix the lowest line he can see to read with correction on a Snellen's chart at six metres, and then to add increasing prisms, base-out, until the patient either is no longer able to read that line or has diplopia. By this means accommodation is not overtaxed, while convergence reserve is stimulated to its limit. The points at which I have been recently trying to arrive since reading Stutterheim's last work are, firstly, what is normal for such a procedure, and, secondly, is any reliable information to be gained from such a diagnostic aid? I am inclined to think that patients complaining of asthenopia frequently show that their convergence reserve estimated at $^6/_4$ Snellen at six metres is never more than 6 to 10 prism diopters, which is definitely below the average normal

figure of 15 prism diopters suggested by Lancaster (1937). In the case of the patient quoted above, it was improved from 8 to 16 or 18 prism diopters after a course of twelve orthoptic treatments. In other patients we have had no difficulty in increasing this figure to 24. Dobson (1937) believes that useful information would be obtained by also measuring the convergence reserve at 33 centimetres. Accommodation for Jaeger I type is effected with both eyes at this distance and then increasing base-out prisms are added until the line becomes blurred.

Although the matter under discussion is open to debate, I do think it worthy of more accurate investigation. Probably the examination of 100 normal persons and 100 asthenopes along these lines might reveal some useful figures.

It is interesting to note that usually, accompanying this convergence, weakness is a marked defect in the accommodation reserve. The lowest Snellen line seen with correction is taken, and increasing concave lenses are placed before each eye separately while the other is occluded. It will be seen that figures as low as –1·0 diopter are obtained in cases of marked convergence insufficiency, and that when the convergence reserve with exercises has improved to 15, there will follow an improvement in accommodation reserve to as high as –9·0 diopters with each eye separately, provided that special attention in orthoptic training has been paid to this feature. The result of this is immediate relief from symptoms, but regular home exercises for some months are necessary to maintain this relief.

SUPPRESSION.

The next subject I should like to speak about is suppression, which is the bugbear of orthoptics. Suppression is difficult to overcome, and improvement is often followed by relapse; it has thus been the despair of not a few.

I should like to make reference to the new work which is being done in America on aniseikonia and iseikonic lenses. I refer chiefly to the work of Madigan, Carleton, Ames and Ogle with Bielschowsky (1932 to 1939) in this direction. I would first mention that while in New York, I made a short inspection of an ophthalmo-eikonemeter of the American Optical Company, and was subjected to a test on this diagnostic plant. I could meet all requirements with my own normal binocular vision, but when one eye was made aniseikonic, I found it impossible to complete the test with accuracy. These instruments are not yet available for general purchase, and are definitely expensive. Madigan and Carleton (1932) first showed that many people with emmetropia had inequality of retinal images, but in symptomless persons the error did not amount to as much as 1%, whereas those with varying symptoms all showed a difference of above 1%. The actual average was 0·55% for normal people and 1·55% for those with symptoms.

Ames and Ogle (1932) pointed out that two or three times the threshold of difference in refractive error (+0·12 diopter) is generally considered sufficient to cause ocular trouble, and therefore by analogy two to three times the threshold value of size discrimination (0·5%) should be sufficient to cause ocular symptoms. The following figures given by Carleton and Madigan (1937) are of interest. Of 829 patients examined for aniseikonia, 625 were given prescriptions for aniseikonia. Five hundred patients continuously wore

glasses for aniseikonia and 425 of them replied to a *questionnaire*. Of the 425 patients, 283 in reply reported definite relief from aniseikonic correction; 103 of the 283 patients did not have the correction for their error of refraction changed when aniseikonia was corrected; 195 of the 283 patients were anisometropic.

Dearborn (quoted by Bielschowsky, 1938), in testing for reading disability at Harvard University, gives the following figures. Of 221 students with reading disability who were examined for aniseikonia, 194 exhibited aniseikonia. Of the 194 students, 165 exhibited 0·5% to 2% difference in ocular images and 29 showed over 2% difference in ocular images. Of 221 students, 116 showed "marked" reading disability, 10 of the 116 showed no aniseikonia and 106 showed aniseikonia of an average extent of 1·75%. Thirty-five were given correction and 29 showed a decided improvement in reading.

According to Herzau and Ogle (1937), aniseikonia may occur in three ways: (*a*) by asymmetrical convergence, (*b*) as pure aniseikonia without muscle or refractive anomaly, (*c*) by corrected anisometropia.

Bielschowsky (1938), in reviewing cause (*a*) states that "the height proportion of the retinal images may be influenced by spastic conditions of the eye muscle". In regard to cause (*b*), Carleton and Madigan (1937) stress the important fact that aniseikonia has been found in 74 patients with isometropia, and Cass (1937) has also elicited aniseikonia in many cases of squint in which refraction is equal. Therefore no arbitrary deduction can be made from the refractive state as to the amount of aniseikonia to be expected. Discussing cause (*c*), Bielschowsky (1938) writes:

> An aniseikonia which exists together with the difference in image size determined by corrected anisometropy can thus increase, entirely compensate or more than compensate the latter, from which can be explained the tolerance on the one hand for the adjustment of relatively high-grade and the intolerance, on the other hand, for relatively low-grade anisometropia correction.

An interesting point arising from the investigations at Hanover, New Hampshire, is the fact that Carleton and Madigan (1932) found that 71% of the patients examined exhibited definite evidence of suppression. They then studied nine patients suffering from squint who had good visual acuity in both eyes, and found that they gave differences ranging from 3% to 9%. In four out of five patients tested it was found that the dominance of the eyes could be controlled by changing the relative sizes of the retinal images.

We have all known for many years that patients suffering from cataract and anisometropia cannot tolerate their binocular correction when the corrected vision of both eyes is in the vicinity of $^{6}/_{6}$, and this is due to dissimilarity in the sizes of the retinal images. Madigan and Carleton (1932) have found that a difference of two diopters in squint cases produces 4% difference in the size of the retinal images, and considers that this is the limit of symptomless anisometropia or aniseikonia. Table I, taken from Bielschowsky (1938) gives the range of differences and equivalents. The point, then, that requires clearing is in how many cases of squint suppression is precipitated or maintained by aniseikonia. Knowing the high evidence of anisometropia in strabismus, I am inclined to believe that aniseikonia may be responsible for many.

I do think that this line of investigation also should be carried a little further, for if we can prove that aniseikonia is a predisposing factor in suppression, this distressing problem in orthoptics may be nearer solution. If some relation is found between aniseikonia and suppression in squint, then the more elaborate apparatus of the American Optical Company will be necessary in order to help us to correct our difficult cases.

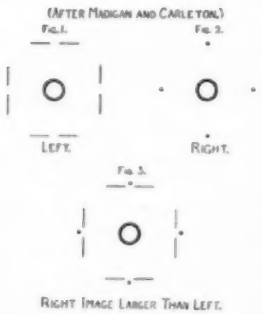
TABLE I.

(*After* Bielschowsky.)

Refractional Power of the Lenses.	Image Enlargement Percentage.
+10	22·5
+5	9·8
+2	3·6
+1	1·7
0	0
−1	1·8
−2	3·4
−5	7·9
−10	14·5

For a moment let me turn to diagnosis. Allen (1932) describes a new method (by the use of Andrew's stereoscopic charts) for the detection of aniseikonia of a low degree. He feels confident that with his test 1% differences can be detected. When it is remembered that a difference in binocular correction of 0·5 diopter produces 1% difference in the retinal image size, it must be realized that Allen's test must be particularly sensitive. Figures 1 and 2, made as orthoptic slides, are useful when inserted in the synoptophore for measuring larger size differences, but in my hands have not proved nearly sensitive enough for routine testing.

Bielschowsky (1938) points out how important the "Tilting Field Test" of Ames is in relation to aviation and how aniseikonia in the pilot may (like muscle errors) produce disastrous results in the landing or taking off. He also points out in the same article that the test must be carried out both for distance and near, as variations occur in the amount of the error when estimated for these positions.



Finally, the following should be kept constantly in mind by practising ophthalmologists. Eggars (1937) has recently emphasized that concave lenses placed closer to the eye than the anterior principal focus, namely 15·7 millimetres, increase the size of the retinal image, and convex lenses in the same position decrease the retinal image size. For instance, a −6·0 diopter spherical lens at 11 millimetres from the cornea gives a 2·9% increase over the same lens at 15·7 millimetres, while a +6·0 diopter spherical lens at 11 millimetres decreases the size by 3·8%. Eggars suggests that discomfort in anisometropia might be reduced by paying attention to this fact when prescribing.

MEASUREMENT OF THE "TROPIAS".

Finally, I should like to make an appeal for the more careful estimation of muscle errors. The Maddox rod test is usually made on a tangent scale with the rod before one eye only (usually the right), and seldom is the test repeated with the rod changed over to the other eye; unless both eyes are dissociated in turn, most cases of alternating hyperphoria are going to be missed and all cases of incomitance. I admit that this is time-absorbing, but

it is the only accurate method (Bannon, 1939). I would therefore suggest that the Maddox wing test for near vision be supplemented with the Rosen foriograph. This latter instrument, while not so sensitive as the wing test (in so much that it produces only dissociation of colour and not of form), does allow the dissociation to be alternated. Bielschowsky (1936) also stresses the importance of at least two separate muscle examinations on every anisophoric patient, and carefully points out that one single test may prove misleading. With this I concur. He also stresses the view that for the muscle tests to be complete they should be carried out in the nine cardinal positions of the eyes; by this means an over-action or paresis will not be missed. Bielschowsky (May, 1937) also advocates the after-image test for investigation of anomalous correspondence, but I should like to stress the importance of the much neglected and simple cover test in this direction. The cover test should be our first procedure in all muscle examinations.

In conclusion, I trust you will not find my suggestions too nebulous for your consideration and investigation. If a solution for suppression alone is found in this decade, the work of the Dartmouth Eye Institute at Hanover, New Hampshire, will be well repaid. I must here acknowledge with gratitude the help which I obtained from this institute in the preparation of the section of this paper dealing with suppression.

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LIVER DAMAGE IN THYREOTOXICOSIS.

By NORMAN WYNDHAM,[1]
Sydney.

IN a study of liver damage in thyreotoxicosis an examination was made of *post mortem* material from 43 autopsies performed at the Royal Prince Alfred Hospital, Sydney. In six cases macroscopic examination alone was made. The clinical histories in all cases were investigated. In no instance was any attempt made to carry out liver function tests.

GENERAL SURVEY.

All specimens were from adult females. In ten cases the weight of the liver was less than 1,000 grammes. In six instances only did it weigh 1,300 grammes or more. The majority were therefore smaller than normal. There was no relationship between liver damage and size. No relationship existed between liver damage and the existence of a persistent thymus. In 16 cases the thymus was present, but in four of these it was acellular and fatty.

MICROSCOPIC APPEARANCE OF THE LIVER.

Reference to the clinical notes showed that in nearly every case death had been accompanied by the signs and symptoms characteristic of thyreotoxicosis of a fulminating type. Despite this, there was a distinct lack of uniformity in the histological appearance. All specimens could, however, be grouped roughly under four headings, similar to those employed by Cameron and Karunaratne (1935).

Passive Venous Congestion.—Under the heading of passive venous congestion were placed the greatest number of specimens, namely, 13. In these the only changes that could be seen were apparently due to congestive cardiac failure. In this group none were included in which there was any obvious sign of real liver damage or degeneration.

Fatty Change without Liver Atrophy.—Fatty change without liver atrophy was the next group in order of frequency, and included 10 cases. The degree of fatty change varied enormously. It may depend on the degree of glycogen depletion which has been demonstrated by many workers in laboratory animals as a result of feeding with thyreoid substance. One would expect some relationship to exist between the degree of fatty change and the length and severity of the hyperthyreoidism, since all patients were submitted to treatment which differed only in minor features. This could not be demonstrated.

Early Cirrhosis.—In six specimens there was an increased amount of connective tissue in the portal canals (sometimes to a considerable extent), patchy lymphocytic infiltration, areas of regeneration of liver cells, and

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occasionally minor degrees of liver atrophy in small foci (Figure I). It is possible that the significance of the changes described has been exaggerated. Weller (1930) described an interlobular, chronic parenchymatous hepatitis in the large majority of 44 autopsies following hyperthyreoidism. This was characterized by lymphocytic infiltration, bile-duct proliferation and increased stroma in the islands of Glissen. The distinction between this picture and

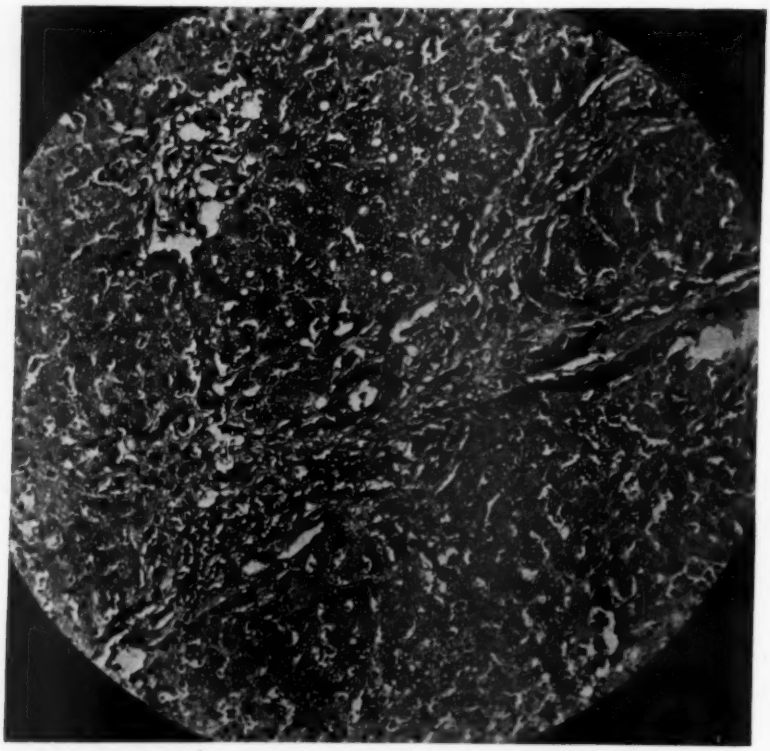

FIGURE I. Liver of patient the cause of whose death was hyperthyreoidism, showing connective tissue increase and round cell infiltration. × 65.

that of an early cirrhosis is not definite, but Weller considers that the condition which he has described is peculiar to hyperthyreoidism and is not a portal cirrhosis.

In one instance (Figure II) the connective tissue was very cellular and immature and spread between the lobules, as well as being very noticeable in the portal canals. Whatever the ætiological factor, it had apparently been operating some short time before death. In most cases the fibrosis had been present for some time and mostly affected the portal systems. No advanced cases of portal cirrhosis were found. It is curious that no instance of manifest portal cirrhosis has been found clinically, when there has been a previous

history of hyperthyreoidism. It must be assumed that the cause does not operate for a sufficient length of time for the fibrosis to become extensive enough to produce symptoms, either because the patient dies or because he is cured.

The number of instances in which these changes were found in this series was small. If it was of any significance in hyperthyreoidism, it should be

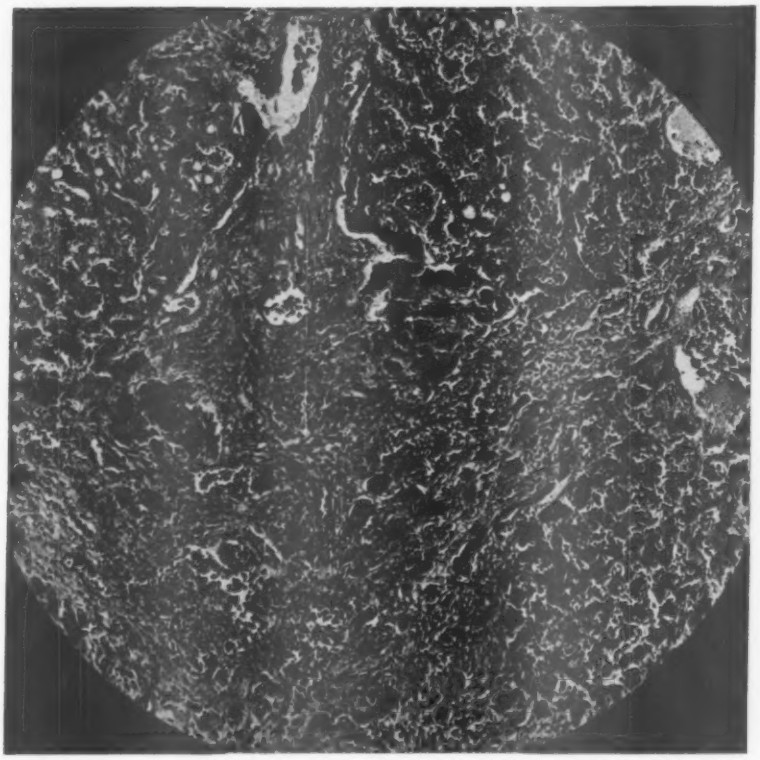

FIGURE II. Early cirrhosis with cellular connective tissue. × 65.

almost a constant *post mortem* feature in these cases. It is admitted, however, that these findings differ from those of some other workers. Marine and Lenhart (1911) stated that in a significant number of long-standing cases coming to autopsy cirrhosis of the liver was present.

Fatty Change with Atrophy.—Eight cases come under the heading of fatty change with atrophy. In most of these there was a pronounced fatty change. In all but two the atrophy was not gross, had a patchy distribution, was most marked at the periphery of the lobule and less marked at the centre. In these areas the lobular arrangement is less definite than normal. There is a blurring of outline and of structure of the hepatic cells.

No great increase of fibrous tissue occurs in these livers. The capillaries in the affected areas are dilated. The remaining two cases are worthy of note. In these two alone was there any evidence before death of liver damage.

CASE I.—D.M.McK. was a married woman of twenty-five years, admitted to the Royal Prince Alfred Hospital under the care of Dr. Mark Lidwill on March 6, 1934. Her condition was very critical. She had lived in Sydney all her life and had had a goitre since puberty. For three years she had suffered from the cardinal symptoms

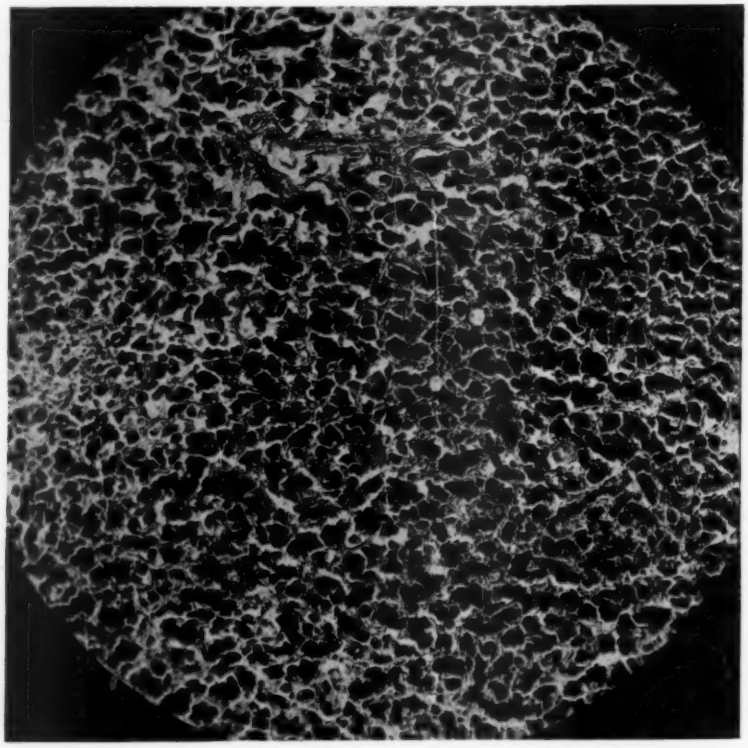

FIGURE III. Liver from case of hyperthyreoidism: subacute yellow atrophy. × 65.

of hyperthyreoidism, but, apart from nausea, had not had any gastro-intestinal disturbance. The amount of weight lost was unknown. Examination revealed that she was about five months pregnant. She had an enlarged, slightly nodular thyreoid, over which a systolic bruit was audible. The pulse was regular, its rate being 130 per minute. The blood systolic pressure was 130 millimetres of mercury, and the diastolic pressure 64 millimetres. Two days after her admission to hospital sugar and acetone were present in the urine, but no albumin. She was too ill to allow of an estimation of basal metabolism, in spite of treatment over two months. On May 26, 1934, labour commenced and a still-born child was delivered under light ether anæsthesia after a short labour. Manual removal of the placenta was necessary. On the evening of the day of delivery, unaccompanied by any rise in blood pressure, the patient appeared very ill and was obviously jaundiced. The urine contained no sugar, blood or

acetone then, but on the following day contained blood and bile, a heavy deposit of albumin and granular casts. Death occurred two days after delivery.

It would be useless to try to determine whether the hyperthyreoidism or the pregnancy was the direct cause of the liver atrophy. The case has, with or without justification, been included in this series because the appearances are not typical of those found in the toxæmias of pregnancy.

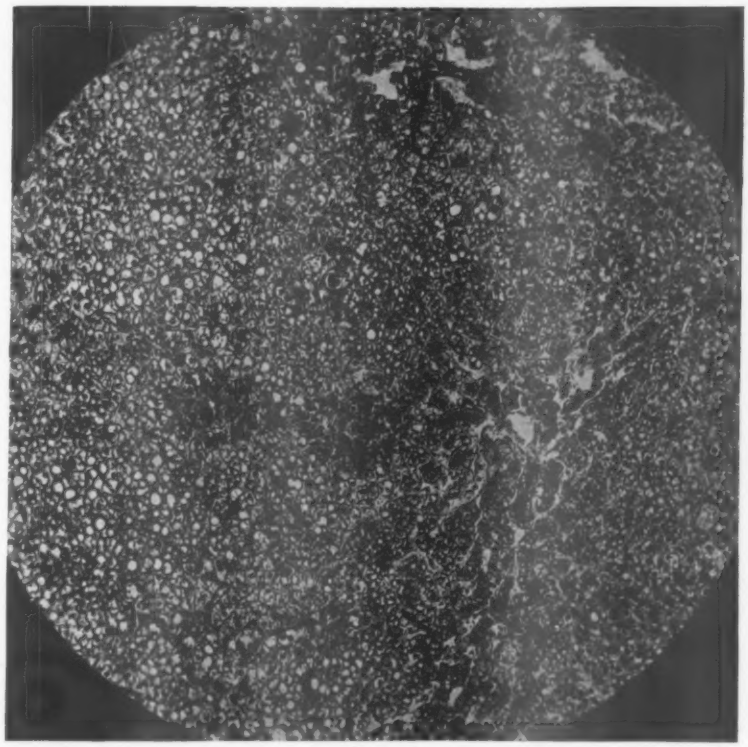

FIGURE IV. Liver from case of subacute yellow atrophy in hyperthyreoidism. × 65.

Post mortem examination was performed. The thyreoid weighed 120 grammes and showed a diffuse hyperplasia of an extreme degree. The thymus was small and fatty. Toxic spoiling of the myocardium, well-marked atrophy of the pancreas, including the islet tissue, and an acute parenchymatous nephritis were also present.

The liver weighed 1,270 grammes and was therefore not very small. The peritoneal surface had an irregular pallor. The cut surface did not show any hæmorrhagic or pigmented areas. Microscopically (Figure III) there is a patchy atrophy of wide extent, with an exaggeration of the appearances described above. There is only a slight amount of fatty change.

CASE II.—L.M. was a single woman of twenty years, admitted to the Royal Prince Alfred Hospital, under the care of Dr. H. R. G. Poate, on June 28, 1937. The patient presented the characteristic picture of Graves's disease, which had been present for two

years. During the greater part of this time she had had iodine medication. She received treatment for two months after admission to hospital, with no effect. Three days before her death she complained of acute abdominal pain, which was soon followed by jaundice, and death was accompanied by the signs and symptoms characteristic of acute yellow atrophy of the liver. *Post mortem* examination was performed.

The thyreoid weighed 142 grammes and showed a hyperplasia which was diffuse and disorderly. The thymus was large and cellular. The liver weighed 1,650 grammes. The gall-bladder and bile ducts were normal. The cut surface of the liver was bright yellow and dry, and no red areas were to be seen. In parts of the liver examined microscopically the atrophy was intense and loss of outline and structure of the liver cells and a blurring of the lobular arrangement were seen. In some areas there were definite indications of cellular regeneration. (See Figure IV.)

In view of the clinical history, one might have expected even more pronounced changes.

In roughly 25% of this small series of cases, therefore, varying degrees of atrophy of the liver were found. According to several workers, for example, Weller (1930), Beaver and Pemberton (1933) and Rössle (1933), the incidence of atrophy is higher. Beaver and Pemberton found it in 91·5% of their cases. The figures in the series described in this paper are in accordance with those of Cameron and Karunaratne.

DISCUSSION.

The association of thyreotoxicosis and liver damage is less constant than might be expected, in view of experimental findings. Cramer (1913), Kurijama (1917), Sanger and Hun (1932) and Kugelmann (1931), among others, have shown that the capacity of the liver to store glycogen is diminished in hyperthyreoidism, but this is denied by Richardson, Levine and du Bois (1926). Most of this work has been done on laboratory animals. In a series of 450 patients suffering from thyreotoxicosis and treated at the Royal Prince Alfred Hospital, only six had glycosuria. In four cases this was transient and disappeared before operation. In one case it disappeared soon after operation. The part played by the operation in clearing the glycosuria in this case is doubtful.

The patient was a male, aged forty-eight years, who was admitted to the hospital on June 17, 1938. Following an accident six years previously, he had suffered from weakness and tiredness, shortness of breath on exertion and loss of weight. He had signs of nervous instability, but no gastro-intestinal disturbance or sweating. He was found to have a moderately enlarged thyreoid gland and a large amount of sugar in the urine. His sugar tolerance test was typical of *diabetes mellitus*, the half-hourly readings of blood sugar content being 210, 300, 390, 320 and 330 milligrammes per 100 cubic centimetres. In spite of careful dieting and appropriate amounts of insulin, the glycosuria and hyperglycæmia were poorly controlled. Glycosuria was still present on a diet of 1,500 Calories and 70 units of insulin per day. The ketosis which had existed previously, disappeared. The basal metabolic rate on June 22, 1938, was +37%, and on July 7, 1938, was +28% after three weeks' treatment on iodine with rest. On July 14, 1938, a hemithyreoidectomy was performed by Dr. T. M. Furber. On the third day following the operation the patient had frank hypoglycæmia and the insulin was suspended. He has had no insulin since and was discharged four weeks later on a 2,000 Calorie diet, with no hyperglycæmia or glycosuria, and a basal metabolic rate of −2%. His carbohydrate metabolism has remained unchanged until now (ten weeks after the operation).

In experimental work it has been taken for granted that the disturbance of sugar storage is due to hepatic deficiency alone. Pancreatic fatty degeneration was found in three instances, fibrosis in one, and necrosis in another case of this series out of seven in which examination was carried out.

Many attempts have been made in the human subject to show that the liver function is depressed in hyperthyreoidism, for example, by Maddock (1936), Lichtmann (1932), Youmans and Warfield (1926), Bartels and Perkin (1927), and by Kugelmann (1931), by means of various so-called liver function tests. According to Professor Rössle (1933), the diminution in liver glycogen diminishes the capacity of the liver to resist the destructive action of various toxins, chemical or bacterial. In his opinion, a severe grade of liver atrophy, manifest clinically, is common in hyperthyreoidism and is the most frequent cause of thyreoid crises. Cases of frank, acute atrophy, such as have been recorded by Kerr and Rusk (1922), Barker (1913), Assmann (1931), Heilmeyer (1931) and several others, are uncommon. Many instances of jaundice occurring in association with hyperthyreoidism have been recorded, but in many of these the jaundice has been of a simple obstructive type due to some cause other than the thyreoid toxæmia. Certainly no other workers but Beaver and Pemberton (1933) have found jaundice in 21·5% of cases. In the series of 450 cases mentioned before, the two recorded in this paper were the only ones in which jaundice was present. A clinical study of the same series failed to reveal satisfactory evidence of any constant impairment of liver function.

The examination of the autopsy material used in this study suggests that the liver does not play an obvious part in death from hyperthyreoidism. Despite a similarity in mode of death, no constancy could be found in the presence or degree of liver damage.

ACKNOWLEDGEMENTS.

Much help was afforded in the writing of this paper by Dr. G. Davies, of the department of pathology, Royal Prince Alfred Hospital, who made *post mortem* material and reports available, and by Dr. A. J. Canny, of the department of pathology, the University of Sydney, for his advice and discussion of many of the sections examined. The photomicrographs were prepared by Mr. L. Schaeffer, department of anatomy, University of Sydney.

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Surgical Technique.

THE TECHNIQUE OF PANHYSTERECTOMY.[1]

By F. A. MAGUIRE,
Sydney.

Preliminary Treatment.

THE essential preliminary to a panhysterectomy for carcinoma of the *cervix uteri* is to render the cervix as surgically clean as possible. This may be attained by removing most of the original growth by diathermy, using the electric scalpel to remove the bulk of the growth and the coagulating button to dry the raw area that is exposed. Daily douches for three to four weeks will clear away the sloughs and leave a clean surface. In advanced cases it may be necessary to repeat this procedure twice or even three times at intervals of two or three weeks. By this means foul fungating growths are cleared up locally, bleeding is arrested, discharge diminishes, cachexia is reduced, and the general condition of the patient is greatly improved. When the cervix is clean, the surgeon may proceed with the operation with a greatly diminished risk of that post-operative sepsis which has been one of the main causes of post-operative mortality.

The same result may be obtained by application of radium. It may be applied after the electric scalpel has been used to remove the main mass of the growth. The dose usually given is 5,000 milligramme hours. Fifty milligrammes of radium are used, distributed in five tubes of ten milligrammes each, and each screened to two millimetres of platinum. Two tubes are placed in a rubber tube and inserted in the cervical canal. The other three tubes are placed in corks and lodged in the two lateral and anterior fornices of the vagina. The vagina is packed with gauze and closed with sutures while the radium is in position. It remains for 100 hours. The operation is performed four to six weeks later.

The Operation.

Step I.

In the first step, with the patient in the lithotomy position, a catheter is passed to ensure that the bladder is empty. This should be done by the surgeon, as a partially filled bladder is a serious obstacle to encounter when the abdomen has been opened. If the bladder should be found in this state, the patient should be put flat and a catheter passed.

Step II.

In the second step a toilette is performed by painting the vagina with tincture of iodine and packing it very firmly with wide strips of iodoform gauze which are firmly tied together. A long tail is left out of the vaginal orifice and carried out between the

[1] Accepted for publication on November 25, 1938.

patient's thighs so that at a later stage it can be withdrawn by a nurse when the surgeon directs.

The patient is placed in a high Trendelenburg position; the abdomen is opened by a mid-line incision which should extend from immediately below the umbilicus to the pubes. It is essential that the incision should be large.

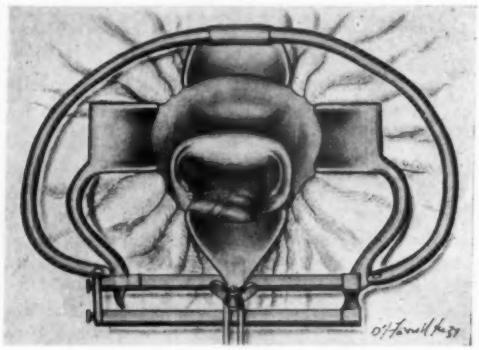

FIGURE I.

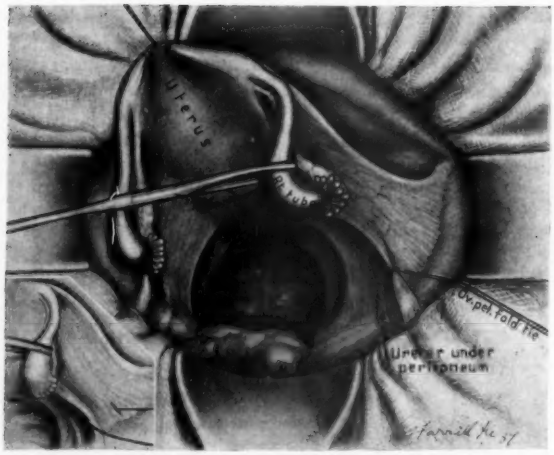

FIGURE II.

The following points are to be noted in opening the abdomen:

1. Make a large incision to give full exposure.

2. In place of small dry swabs for hæmostasis it will be found more useful to use a large sponge wrung out of hot saline solution and placed firmly in the wound. By

lifting the edge of the sponge, the surgeon can see any vessel that is bleeding freely and apply artery forceps. By this means the wound is kept dry and oozing is reduced to a minimum.

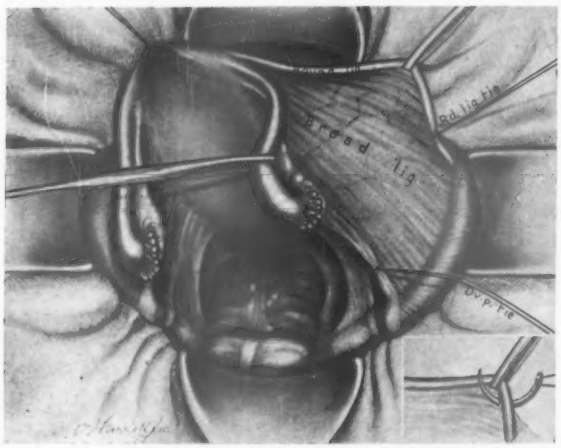

FIGURE III.

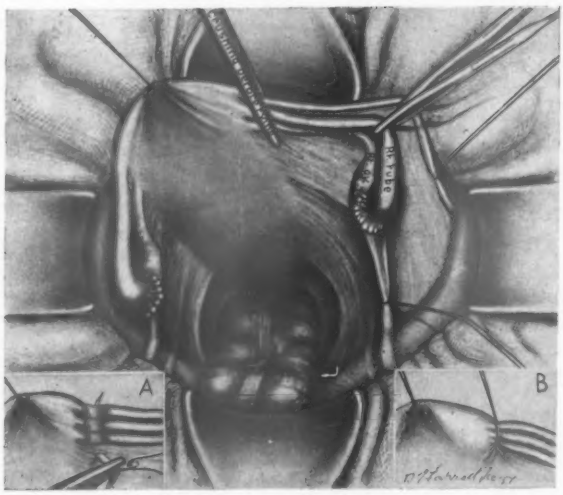

FIGURE IV.

3. When the abdomen has been opened, the edge of the peritoneum at the lower end of the incision is picked up and anchored to the skin at the lower end by catgut threaded on a cutting needle. This is a useful step, as it prevents the peritoneum from sliding down behind the pubes over the bladder.

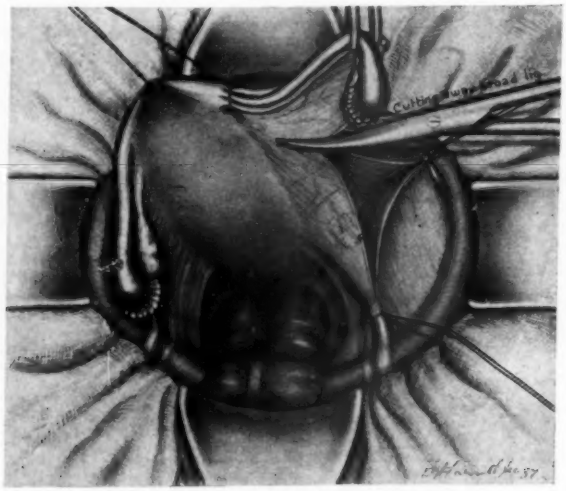

FIGURE V.

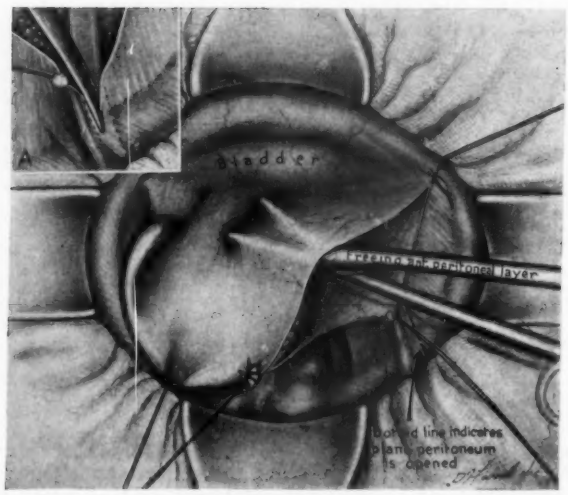

FIGURE VI.

If the patient is properly anæsthetized the abdominal muscles will be flaccid and the bowels will fall away into the upper part of the abdomen, leaving the pelvic viscera exposed. Large sponges are placed along the margins of the wound and large abdominal retractors are placed in position. Excellent exposure is given by the retractors designed by the author (Figure I). By this means the bladder, the uterus with the tubes and ovaries, the ovarico-pelvic folds, the round ligaments, the pouch of Douglas, the rectum and the brim of the true pelvis are fully exposed.

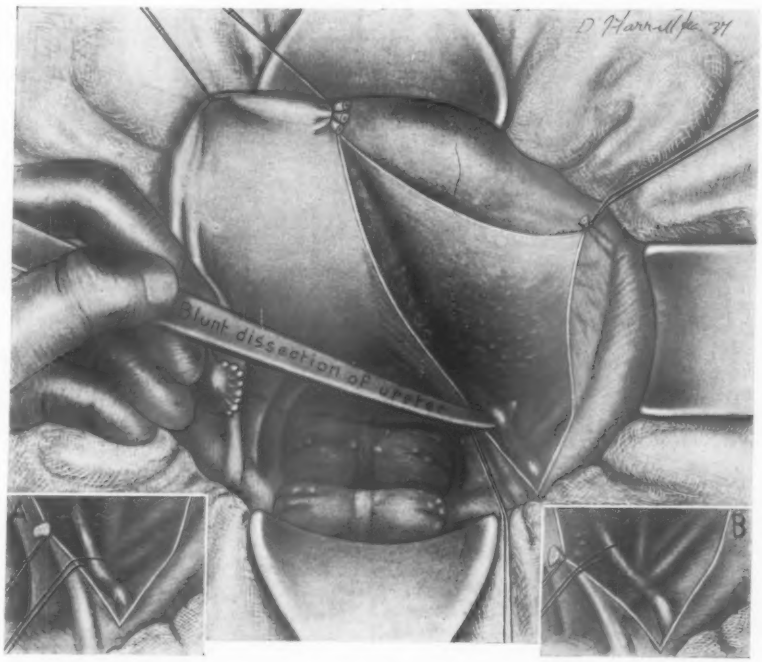

FIGURE VII.

The surgeon should always pick up the ovarico-pelvic fold on both sides and expose and recognize the ureters at this stage. It is not generally recognized that the ureter crosses the pelvic brim immediately behind and in close relation to the ovarico-pelvic fold. The ureter can be seen lying immediately under the peritoneum and running obliquely downwards and inwards on the lateral pelvic wall. It is about 2·5 to 3·0 millimetres in width and is whiter than any other structure in the vicinity. If it is watched for a few seconds, waves of peristalsis will be seen running down along the course of the ureter. No other structure in the pelvis exhibits this phenomenon.

Step III.

The third step is shown in Figure II. A traction suture of catgut is passed through the *fundus uteri* and tied; a pair of artery forceps is attached to it. It is used to draw the uterus well up out of the pelvis in order that the tubes, ovaries and round ligaments may be easily seen.

Step IV.

In step IV (Figure II) the right tube and ovary are seized with a bile duct clip and are lifted so as to put tension on the ovarico-pelvic fold and to lift it up from

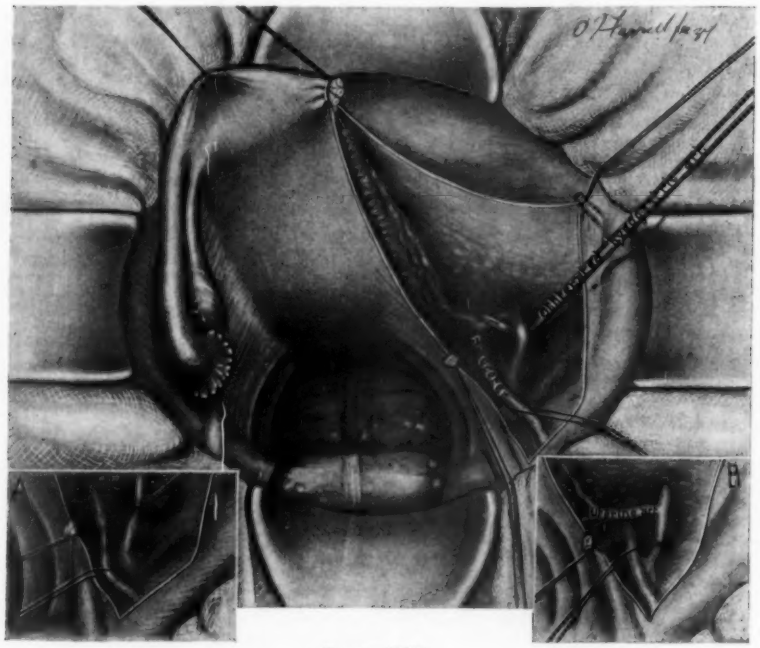

FIGURE VIII.

the brim of the pelvis. A ligature is passed around the ovarico-pelvic fold, well out towards the brim of the pelvis; it is tied and the ends are left long. It is at this stage particularly that the surgeon must make sure that he recognizes the ureter and avoids including it in this ligature.

Step V.

In the fifth step (Figure III) the round ligament is picked up close to the pelvic brim with a bile duct clip and a ligature is tied around it at this point (see inset, Figure III).

Step VI.

In step VI (Figure IV) the three structures which are attached to the cornu of the uterus, namely, the round ligament, the uterine tube and the ovarico-uterine ligament (or the ligament of the ovary), are now picked up together. A Kocher's forceps is passed over the three structures and down the front and back of the broad ligament just lateral to the lateral margin of the uterus and firmly closed. This will crush all the vessels entering and leaving the uterus at the cornu. It will include the anastomosis between the uterine and ovarian vessels and the vessels of the round ligament.

FIGURE IX.

Note that the vessels between the layers of the broad ligament are very variable both in number and distribution. If the broad ligament is held up so that the light shines through it, the vessels can be seen. The point of the Kocher's forceps needs to be down to the "bloodless area" below the lowest of the vessels seen in the top of the broad ligament, otherwise there will be troublesome oozing when the broad ligament is opened. This will obscure the field.

The structures in the grasp of the Kocher's forceps are thoroughly crushed. The forceps are now removed and a ligature is placed along the path of the crushed tissues and firmly tied (see insets A and B, Figure IV).

Step VII.

In the seventh step the peritoneum of both layers of the broad ligament is cut through with scissors medial to the ligatures on the ovarico-pelvic fold and the round ligament (Figure V). The connective tissue space between the layers of the broad ligament is thus opened up. The cut edges of peritoneum should be inspected carefully for any of the aberrant vessels referred to in step VI. If there are any, they should be picked up and tied at this stage. The tube and ovary may now be cut away at a point just lateral to the ligature on the cornu of the uterus, in order that they will not

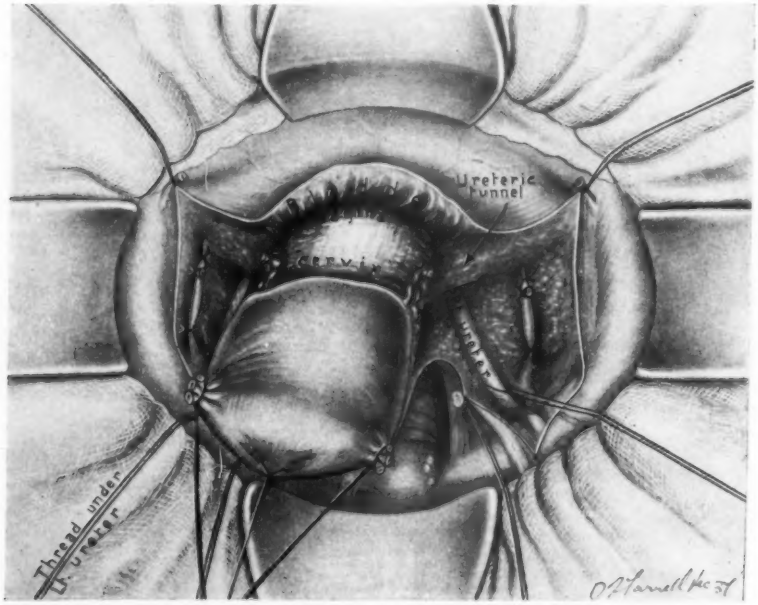

FIGURE X.

obstruct the field. The ligature on the structures at the cornu of the uterus can be picked up with the artery forceps which is on the traction suture in the *fundus uteri*. By means of these two ligatures strong traction can be exerted on the *fundus uteri*.

Step VIII.

In step VIII (Figure VI) traction is placed on these ligatures and the uterus is drawn back to expose its anterior surface and the upper surface of the bladder. The tip of a Mayo's scissors (curved on the flat) is inserted under the peritoneum on the anterior surface of the uterus and gently insinuated towards the mid-line. By this means the peritoneum which is loosely attached to the front of the uterus is separated

and cut through, as much peritoneum as possible being saved. The anterior layer of the broad ligament can now be pushed down with a swab to expose the top of the bladder. It is better not to push the bladder down at this stage, for if it is pushed down to one side of the mid-line small veins may be torn and much oozing may result.

Step IX.

In the ninth step the peritoneum is picked up at the pelvic brim to the outer side of the ligature on the ovarico-pelvic fold (Figure VI, inset A). A blunt dissector is passed upwards and outwards for about two inches, parallel to and along the outer border of the ovarian vessels. The peritoneum is cut along this line. If the medial

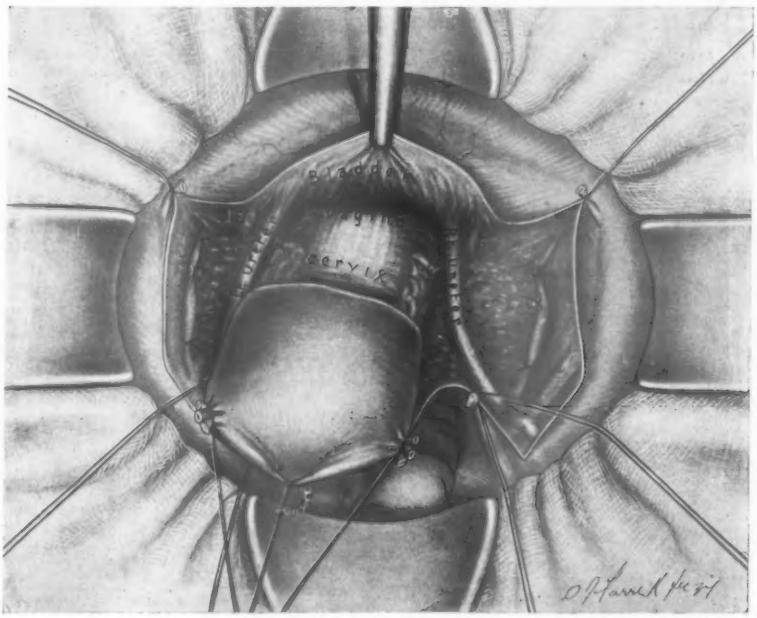

FIGURE XI.

edge of the cut peritoneum is drawn firmly inwards, the ureter will be exposed crossing the common iliac artery at or just below its bifurcation into the external iliac and hypogastric (or internal iliac) arteries. The ureter is closely attached to the deep surface of the peritoneum and usually is carried inwards with it. It must be carefully sought and isolated and separated from the peritoneum with the point of a blunt dissector. When this is done, a fine chromicized gut ligature is passed beneath it. This ligature is not tied, but is used as a tractor to lift the ureter and as a quick and ready means of recognizing the ureter (see Figure VII and insets A and B).

Step X.

In the tenth step the peritoneum of the posterior layer of the broad ligament, together with the ureter (which is usually closely adherent to it), is now retracted inwards with the tip of the forefinger of the right hand. Both forefingers are now inserted into the space, and the connective tissue in the deeper parts of the broad ligament which extends out to the lateral wall of the pelvis is opened up. By this means the hypogastric (internal iliac) artery is exposed as it runs down on the lateral wall of the pelvis. At a depth of from one and a half to two inches below the origin

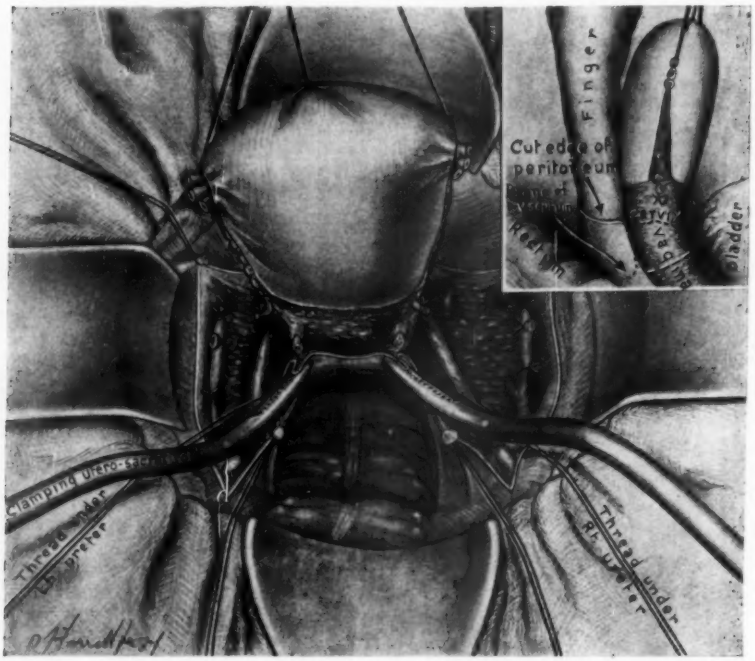

FIGURE XII.

of the hypogastric (internal iliac) artery the uterine artery can be felt by the tip of the finger as a curved cord running forwards and inwards towards the *cervix uteri*. It is made more apparent by retracting the uterus strongly to the opposite side. In nine out of ten patients the uterine artery arises from the obliterated hypogastric artery, which will be seen running forward on the lateral wall of the pelvis (Figure VII, inset B). A little dissection with a blunt dissector will expose the uterine artery in its course towards the uterus. It crosses over the ureter, which disappears under the artery as the ureter passes downwards and forwards towards the bladder. A deliberate dissection is

necessary to separate the two structures and to free the ureter from the uterine artery with its associated veins.

Note that in Figure VIII the blunt dissector is passed under the trunk of the obliterated hypogastric artery at a point just before the uterine artery branches off from it. In inset A the ureter has been drawn medially. A ligature has been placed on the proximal part of the obliterated hypogastric artery. In inset B the latter artery has been cleared to a point beyond the origin of the uterine artery from it, and another

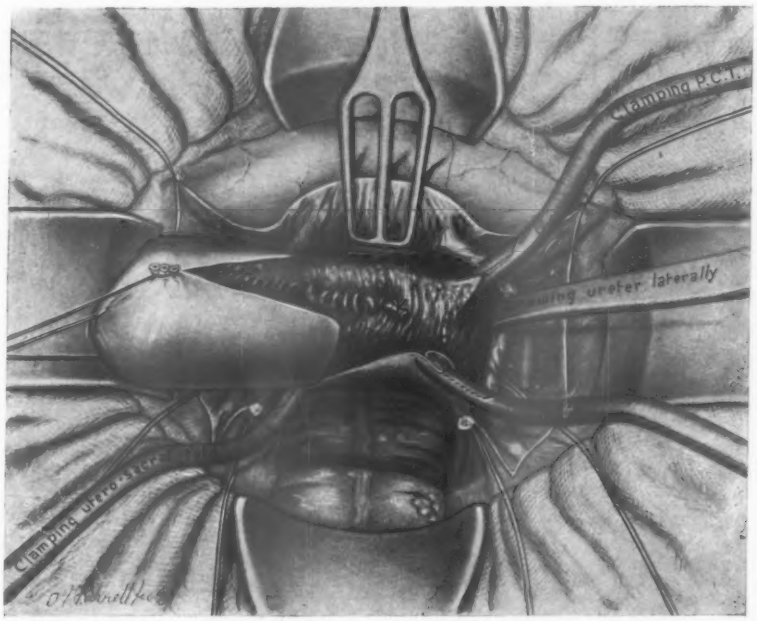

FIGURE XIII.

ligature has been placed on the obliterated hypogastric artery distal to the origin of the uterine artery. The ureter is shown passing beneath the uterine artery and disappearing into the deeper part of the pelvic connective tissue.

Step XI.

In step XI a ligature carrier is passed under the uterine artery to lift it well clear of the ureter (Figure IX). Two ligatures are passed round the uterine artery and tied. The artery is lifted well clear of the ureter and is cut between the ligatures (see insets A and B).

Step XII.

In step XII (Figure X) the medial end of the cut uterine artery is retracted inwards towards the uterus. This exposes the pelvic connective tissue into which the ureter disappears. The point of the little finger can be passed along the upper surface of the ureter with the nail surface against the ureter. The pulp of the finger will raise the pelvic connective tissue off the ureter in the form of a band. This is the roof of the "ureteric tunnel" of Victor Bonney. This connective tissue may contain some

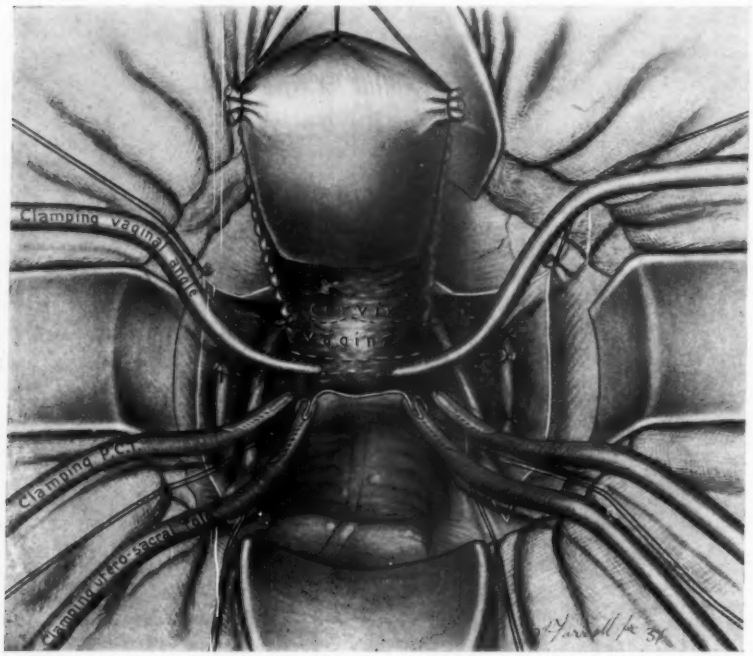

FIGURE XIV.

small veins. It is best to ligate it in two places before cutting it through. The course of the ureter through this connective tissue is about half an inch in length. Some dissection with a blunt dissector will still be necessary to free the ureter from the lateral wall of the vagina. The ureter should be displayed up to the point where it enters the bladder.

Step XIII.

In step XIII a swab placed over the tip of the index finger or held firmly in a swab-holding forceps may now be used to push the bladder off the vagina in the

mid-line. This is almost a bloodless plane. It may be necessary to do a little dissecting with a blunt dissector and even to tie one or two vessels in separating the bladder from the lateral part of the anterior wall of the vagina. When this is done the bladder and the ureter may be rolled quite clear of the vagina on the right side. The ureter should be freed from the side of the vagina so that it can be lifted quite clear (see Figure XI).

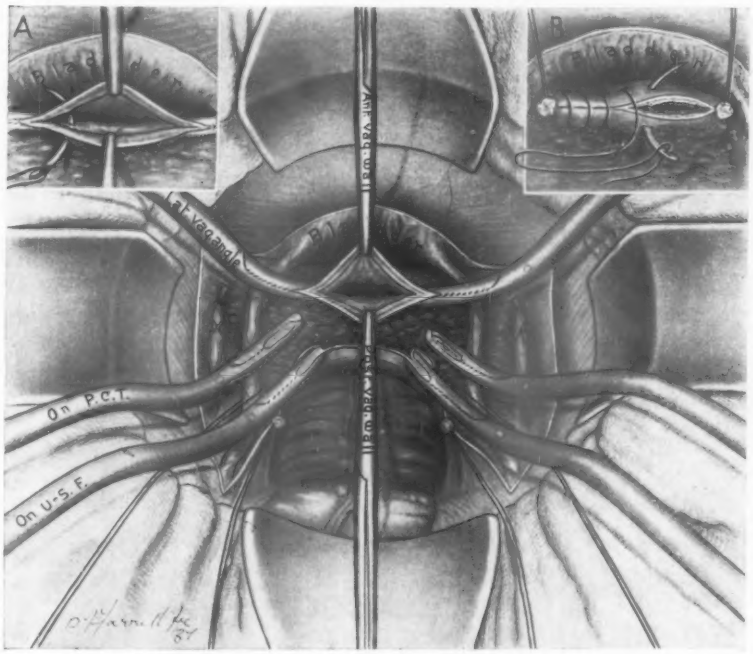

FIGURE XV.

Step XIV.

Steps X, XI, XII and XIII should now be carried out on the left side of the pelvis so that the left ureter is completely exposed and freed up to the point where it joins the bladder (see Figure XI). This may be called the fourteenth step.

Step XV.

In step XV the uterus and vagina are drawn strongly forward by the traction sutures attached to the fundus and the cornua. The posterior layer of the broad ligament is cut through down to the level of the attachment of the utero-sacral fold on either side (Figure XII). A large pelvic forceps is placed on each utero-sacral fold

close to the uterus. The peritoneum and the attachments of the utero-sacral folds are now freed from the back of the uterus and a search is made for the plane of cleavage of the recto-vaginal septum. When it is found, the tips of three fingers of the right hand can be passed down as far as is considered necessary behind the vagina, which is thus freed from its posterior relations. (See inset, Figure XII.)

Step XVI.

In the sixteenth step (Figure XIII) the ureter is retracted towards the lateral wall of the pelvis, while the bladder is retracted forward. The vagina is freed anteriorly

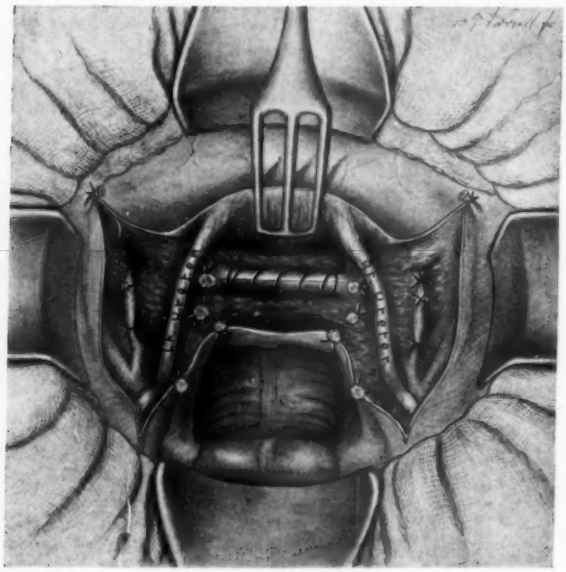

FIGURE XVI.

as far down as the surgeon considers necessary. A nurse now withdraws the gauze from the vagina. The surgeon, by passing the thumb in front and the index and middle fingers behind the vagina, can feel the lowest level of the *cervix uteri* and estimate with accuracy the amount of vagina he wishes to remove with the uterus. A large pelvic forceps is applied to the paravaginal connective tissue, below the level of the *cervix uteri* on each side. With long strong scissors the paravaginal tissue is cut through. The vagina, thus freed from its lateral attachments, can now be drawn still further up into the wound and put on the stretch.

Step XVII.

In step XVII (Figure XIV) a pelvic forceps is placed on each lateral margin of the vaginal wall at a point half an inch below the level at which the surgeon decided to amputate the vagina. The vagina is now cut across with stout scissors (Figure XIV) and the mid-point of the cut anterior and posterior walls is seized with Kocher forceps (Figure XV). The inside of the vagina has been thoroughly disinfected by

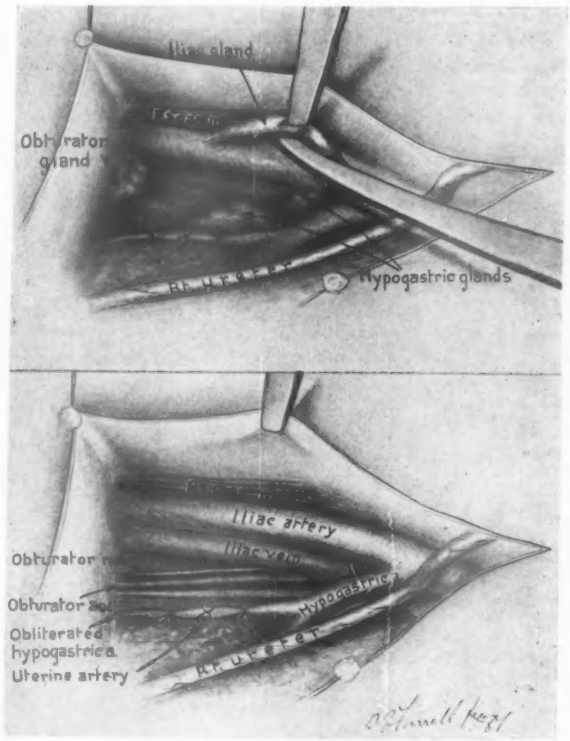

FIGURE XVII.

the tincture of iodine and iodoform gauze which was packed in before the operation commenced, so that the surgeon has opened into a surgically clean cavity.

Step XVIII.

In step XVIII (Figure XV, inset A), after tying off the lateral angles of the vagina, the top of the vagina is closed with a continuous suture of light chromicized gut. If hæmostatis has been properly carried out, there is no need to drain the pelvis through the vaginal vault.

Step XIX.

In step XIX (Figure XVI) all the pelvic forceps are removed after ligature of the tissues in their grasp. The ureters and bladder are allowed to fall back into their place. All bleeding points are secured and a large warm sponge is packed into the floor of the pelvis.

Step XX.

In step XX (Figure XVII) the gland-bearing connective tissue at the brim of the pelvis and along the lateral pelvic wall is dissected out in one continuous sheet, together with all the lymph glands and vessels it contains. This dissection should extend

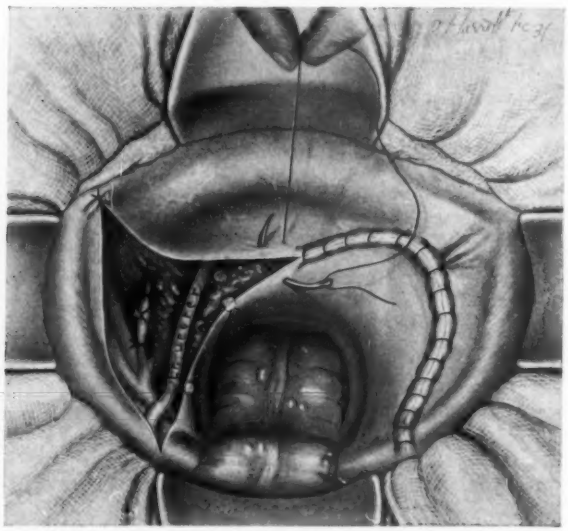

FIGURE XVIII.

from the fascia of the ilio-psoas muscle lateral to the external iliac vessels, commencing at a point proximal to the bifurcation of the common iliac artery and extending along these vessels to within an inch of the inguinal (Poupart's) ligament. It should extend down the pelvic wall so as to clear out any gland masses in the region of the obturator foramen, where very frequently large glands are found. If glands are attached to the external iliac vessels, they should be separated by careful dissection. Rarely is it impossible to do this, even in cases in which the disease has been of long standing, as the infiltration that takes place is into the sheath of the vessels. If the vessel wall is actually invaded, the vessel itself, either artery or vein, may be ligated in two places and the invaded portion may be removed. There is a rich anastomosis by way of the hypogastric vessels to the femoral circulation.

Step XXI.

In step XXI (Figure XVIII) the sponge in the pelvis is removed, a careful inspection is made of the walls and floor of the pelvis for any oozing, while the bladder and ureters are examined to see that they have not been damaged. The peritoneum is then closed by a continuous suture of fine catgut. This commences on the right side at the point above and outside the ovarico-pelvic fold. It is continued across the pelvis to the corresponding point on the left side.

Step XXII.

In the twenty-second step the sponges are removed from the abdominal cavity and the abdomen is closed. In all cases of malignant disease it is advisable to put in several deep retention sutures of silkworm gut as the tissues of these patients frequently have very poor healing qualities, and it is not exceptional to find, if retention sutures have not been inserted, that the wound surfaces have not healed by the time the catgut sutures have been absorbed. As a result the wound is likely to gape or even to burst open. Silkworm retention sutures should be left in for at least ten days.

While the abdomen is being closed, a retention enema (Clarke's) is given through the rectal tube that was inserted while the patient was in the lithotomy position. The enema consists of thirty ounces of tap water with five drachms (2%) of bicarbonate of soda and twelve drachms (5%) of glucose, together with six ounces of "Agarol". This fills the large bowel easily while the patient is in the Trendelenburg position. It reduces post-operative distension, reduces thirst, diminishes vomiting, diminishes shock, and enables the bowels to be moved much more easily.

Acknowledgement.

I am indebted to Mr. D. J. Farrell, artist, of the Anatomy Department of the University of Sydney, for the drawings which have been done by him at the operating table, from actual operations.

Case Reports.

FOREIGN BODIES IN THE LUNGS OF CHILDREN, WITH A REPORT OF FOUR CASES.[1]

By Norman H. Meacle,
Sydney.

Foreign bodies found in the lungs of children may be classified on a diagnostic basis as those that are opaque to X rays and those that are non-opaque. The initial symptoms are choking, gagging, coughing and wheezing, often followed by a symptomless interval, and the initial choking and coughing may have escaped notice or may have been forgotten. Non-obstructive metallic foreign bodies in the bronchi give rise to few symptoms and few signs for weeks or months.

Obstructive foreign bodies cause atelectasis, drowned lung and eventual pulmonary abscess. Peanut kernels or vegetable foreign bodies set up a violent reaction in the bronchi, with toxæmia, cough and irregular fever, the gravity and severity varying inversely with the age of the child.

The physical signs are variable, as the foreign body may change its position and so allow a variable amount of air to pass by the obstruction.

Jackson describes three kinds of obstruction, namely: (i) by-pass obstruction, not unlike a partially closed valve; (ii) check-valve obstruction, in which air passes in, but not out, causing emphysema of the involved lung; (iii) completely shut valve, in which air cannot pass either in or out, the retained air becoming absorbed, with resultant atelectasis of the lung. To understand this mechanism it must be realized that enlargement of the lumen and lengthening of the bronchus occur during inspiration and diminishing of the lumen and shortening during expiration.

The physical signs most likely to be found are: (*a*) limited expansion, (*b*) decreased vocal fremitus, (*c*) impaired percussion note, (*d*) diminished intensity of the breath sounds distal to the foreign body.

Complete obstruction of a bronchus followed by drowned lung causes in addition absence of vocal resonance and vocal fremitus, thus often leading to an erroneous diagnosis of empyema. In cases of obstruction or compensatory emphysema varying grades of tympany may be obtained over the area involved. A diagnosis of pneumonia may be suggested in early foreign body cases due to diminished expansion of one side with dulness; but the diagnosis may be excluded owing to the absence of typical tubular breathing and absence of a decreased vocal resonance. Bronchial obstruction in pneumonia is exceedingly rare. Radiography is the most valuable diagnostic means at our disposal. Peanut kernels and all vegetable substances that lodge in the bronchi practically always produce obstructive emphysema of the affected side. X ray examination shows the diaphragm to be flattened, depressed and with a diminished excursion on the affected side; at the end of expiration the heart and mediastinal wall move over toward the unaffected side, and the lung in question becomes less dense than its healthy fellow as a result of the trapping of the air by the expiratory, valve-like action of obliteration of the "forceps spaces" that during inspiration afford air ingress between the foreign body and the swollen bronchial wall. This partial obstruction causes obstructive emphysema, which must be distinguished from compensatory emphysema, in which the ballooning occurs in the unobstructed lung, because its fellow is wholly out of action through complete "corking" of the main bronchus of the invaded side. Obstructive atelectasis occurs when the obstruction is complete; air below the obstruction is absorbed, the lung collapses, and the mediastinum moves over to satisfy the vacuum. This may occur within a space of twenty-four hours if the foreign body quickly swells to a tight fit. These two radiological signs, obstructive emphysema and obstructive atelectasis, are diagnostic; and to produce this evidence on

[1] Accepted for publication on September 6, 1938.

the film two exposures must be made, one at full inspiration and one at the end of complete expiration.

Case Histories.

CASE I.—The patient, R.B., a male, aged two years, was admitted to hospital with a history of having been ill for nine days. He was feverish, with "wheezing on the chest", vomiting and some cough. On examination the child did not look very ill. There was no respiratory distress, but the right side of the chest moved more than the left. The percussion note was resonant over all areas, but the breath sounds were very weak on the left side of the chest. Vesicular rhonchi, especially on expiration, were present on the right side. There was diminished vocal resonance on the left side. About a week later examination of the chest showed that the base of the left lung was quite dull, with absence of breath sounds and diminished vocal resonance. The child was not very ill, but ran an irregular temperature. Figure I shows a skiagram of the chest, and shows that the left lung is definitely more transradiant than the right, suggesting the presence of a transradiant foreign body in the left main bronchus producing a partial obstruction (obstructive emphysema). There is also atelectasis of the lower part of the left lower lobe. On bronchoscopic examination under ether

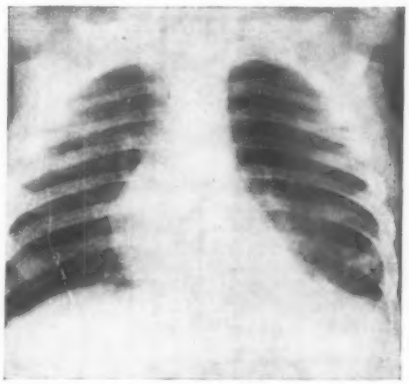

FIGURE I. Case I. Obstructive emphysema of the left lung with atelectasis of the lower part of the left lower lobe, due to a small piece of peanut kernel in the left main bronchus.

FIGURE II. Case II. Obstructive emphysema of the right lung, due to a piece of peanut kernel in the right main bronchus.

anæsthesia an appreciable quantity of pus, together with a small piece of peanut kernel, was removed from the left main bronchus by means of sucker and forceps. After this procedure the child made an uninterrupted recovery, the lung gradually returning to normal.

CASE II.—The patient, L.P., a male, aged two years, was admitted to hospital with a history of having eaten peanuts a few hours previously. It was noticed that the child was wheezing and crying. On examination the child appeared to be well nourished and was crying lustily. The chest was resonant throughout. Breath sounds were vesicular.

Figure II shows a skiagram of the chest taken the next day; the right lung is seen to be unusually emphysematous, suggesting a transradiant foreign body in the right main bronchus. On bronchoscopic examination a piece of peanut kernel was found wedged in the right main bronchus. Under ether anæsthesia bronchoscopy had to be performed five times at intervals of a few days before all the peanut could be removed, as it kept breaking into small pieces when grasped by foreign body forceps. Bronchoscopy was not persisted in on any occasion for a longer period than twenty minutes, and, during the whole time that he was in hospital, the patient's condition remained

very good and he suffered no reaction from bronchoscopic interference. There was a fluctuating temperature, averaging 102° F., for about ten days, and after that a very occasional rise occurred. The patient was finally discharged completely recovered, after about six weeks' stay in hospital.

CASE III.—The patient, S.N., a female, aged five years, was admitted to hospital with a history of having "swallowed" a grasshopper three weeks previously. Cough and occasional distressed breathing had been present ever since. On examination the chest appeared to move evenly, with good excursion. Palpation appeared normal. The percussion note was found to be resonant over all areas and the breath sounds were harsh and diminished in intensity over the right side. Coarse and musical rhonchi were present in the right interscapular region. Other systems were clear, and there was no pyrexia. Figure III is taken from a skiagram of the chest and shows the right lung to be markedly emphysematous, suggesting the presence of a transradiant foreign body in the right main bronchus. Under ether anæsthesia a five-millimetre Jackson bronchoscope was passed and a Bathurst burr was located in the right main bronchus. The burr was closely surrounded and incorporated in gross inflammatory reaction. The foreign body was removed with forceps and the child returned to the ward in good condition. Recovery was uninterrupted and the patient was discharged from hospital ten days later.

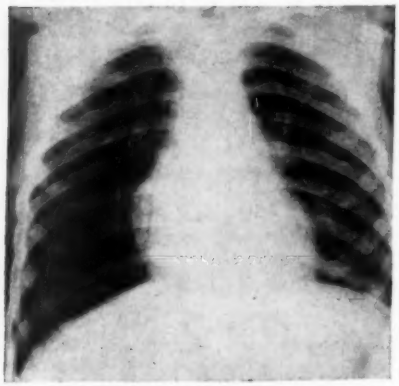

FIGURE III. Case III. Obstructive emphysema of the right lung, due to a Bathurst burr in the right main bronchus.

FIGURE IV. Case IV. Massive collapse of the middle and lower lobes of the right lung, due to obstruction of the right bronchus by fragments of peanut kernel.

CASE IV.—The patient, H.V., aged two years, was admitted to hospital with a note from a medical practitioner stating that the child had symptoms and signs suggestive of a foreign body having been inhaled, although there was no definite history of such occurrence. Very little help was obtained from the parents, and no mention was made that the child had been eating peanuts. The child had had a choking attack and became blue on the day previous to his admission to hospital. On the day of admission the child had another choking attack, with wheezing on the chest. On examination it was noticed that the respiratory rate was considerably increased. Recession of the intercostal spaces was pronounced. The right side of the chest moved less than the left. The right side was slightly dull to percussion, and no breath sounds could be detected in the lower lobe. Air entry into the left lung appeared to be very much increased. The child had a cyanotic tinge and looked very ill.

Figure IV shows a skiagram of the chest taken soon after the patient's admission to hospital, and shows dulness in the right lung, especially of the middle and lower lobes. No foreign body could be detected, and the appearance was very suggestive of pneumonia, but massive collapse could not be excluded. On bronchoscopic examination without any anæsthetic a piece of peanut kernel was found and removed from the

right main bronchus. The child became more restful and the colour improved. The next morning the child was again very restless and slightly cyanotic, and another X ray examination of the chest was made. The child collapsed on the X ray table as the skiagram (Figure V) was being taken. Artificial respiration had to be employed, and

FIGURE V. Case IV. Almost complete collapse of the right lung, due to obstruction of the right main bronchus by fragments of peanut kernel.

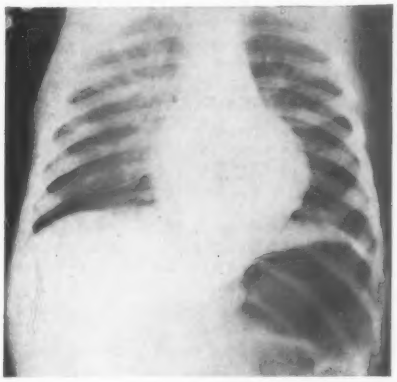

FIGURE VI. Case IV. Taken ten minutes after the X ray picture shown in Figure V, and showing complete aeration of the previously collapsed right lung due to the moving of the non-opaque foreign body (peanut kernel) during the employment of artificial respiration.

FIGURE VII. Case IV. Taken soon after intubation, showing both lungs well aerated.

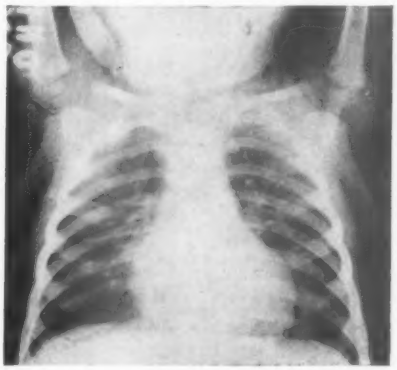

FIGURE VIII. Case IV. Complete recovery one week after all foreign body (peanut kernel) had been removed.

when the child had recovered sufficiently, about ten minutes later, another X ray picture (Figure VI) was taken.

It is very interesting to compare these two X ray pictures (Figures V and VI). Figure V shows almost complete collapse of the right lung, the point of particular interest being that the upper lobe of the right lung now shows massive collapse.

Figure VI shows complete aeration of the previously collapsed lung. This suggests that the non-radio-opaque foreign body had moved during the employment of artificial respiration, incompletely blocking the upper main bronchus. Bronchoscopy was again performed and quite a number of fairly large pieces of peanut kernel were removed from the right bronchus with the aid of forceps and suction. There was an improvement in the child's colour, and on returning to the ward he appeared to be more restful. About two hours later respiratory embarrassment again became pronounced, with recession of the intercostal spaces on both sides of the chest. The child was intubated and placed in a steam tent, the colour improving immediately, and he appeared to be very comfortable. After about twenty-four hours the child was able to breathe comfortably without the tube. Recovery was uninterrupted and the child left hospital a week later, quite well again.

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ATRESIA OF THE DUODENUM: A REPORT ON THREE CASES, INCLUDING TWO IN CONSECUTIVE FEMALE MEMBERS OF THE SAME FAMILY.[1,2]

By Isadore Brodsky,
Sydney.

Among the less common conditions which confront the surgeon, is congenital atresia of the duodenum, and recognition of its occurrence is often deferred until the pathologist reveals the lesion at a *post mortem* examination. Three types have been classified: one in which a diaphragm suspended in a transverse plane acts as a partition between adjacent compartments of bowel; a second, which has as its feature blind ends connected by a band; and a third, in which there is discontinuity between normally aligned segments of bowel.

This contribution deals with the presentation of morphological features of three examples of atresia of the duodenum. Two of the cases occurred in consecutive female members of the same family, and it is believed that this phenomenon has not been recorded previously. An account, not uniformly complete, will be given of the clinical notes, of the *post mortem* examinations, and, where indicated, of the histopathology. Reference will also be made to the question of terminology and to the significant literature of the subject. The two children of Mrs. D. will be referred to as D3 and D4 (the numerals denoting the positions which they occupied in the family); the other child will be designated G.

Clinical Notes on D3.

The infant, a female, was born prematurely (seven and a half months) at the Women's Hospital, Crown Street, Sydney, on September 16, 1936. Her weight at birth was 5 pounds 8 ounces (2,494 grammes). The pregnancy was complicated by hydramnios.

On the second day she began to vomit about an hour after a feed, or just before it. The vomitus consisted of thick yellowish-green material, and the vomiting was projectile in character. After a test feed no peristaltic waves were seen, nor was any mass palpable in the abdomen. Jaundice was present, and the scanty motions consisted of small specks of dark green meconium. On the fourth day she was transferred to the Renwick Hospital for Infants, where she died on the day of admission, the provisional diagnosis being prematurity and *icterus neonatorum*.

Post Mortem Examination.—The stomach was enormously dilated. The pylorus was dilated and the duodenum, greatly distended, terminated distally in a blind pouch. There was no proximal opening to the jejunum, which, with the ileum, was thought to show atresia. The liver was very congested and the gall-bladder full; the latter could not be emptied. No other abnormalities were mentioned. No microscopic sections were made. The diagnosis was congenital atresia of the duodenum, and possibly of the jejunum and ileum.

Clinical Notes on D4.

This subject, a full-time female, was born at the Women's Hospital, Crown Street, Sydney, on January 2, 1938. Her weight at birth was 6 pounds 15 ounces (3,152 grammes). The pregnancy was complicated by hydramnios.

[1] Accepted for publication on September 15, 1938.

[2] This investigation was carried out at the Department of Pathology, University of Sydney, in 1938 with the aid of a grant from the National Health and Medical Research Council.

The notes which were made during the first three days state that the infant vomited and passed meconium. On the fourth day she was very sick. No peristaltic waves were seen, nor was jaundice mentioned. Some thick brownish unformed material on the napkin was suspected to contain blood, but the result of a test for occult blood

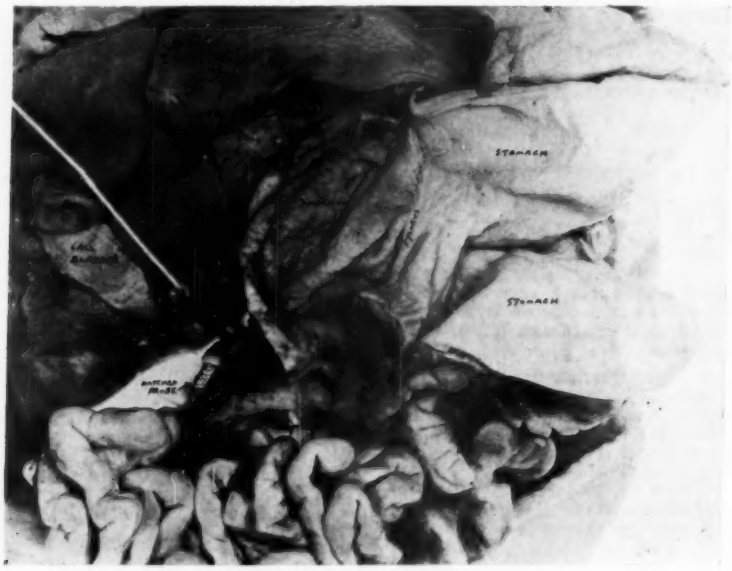

FIGURE I. A dissection to show the general relationships of the structures. The hatched probe is lying in the lumen of the bile duct, which has been exposed in the wall of the duodenum.

was negative. A barium meal was ordered, but the child's condition did not permit this procedure to be instituted. The infant died on January 6, 1938.

Post Mortem Examination.—Post mortem examination was commenced by the hospital pathologist and completed at the university. There were no external abnormalities. The œsophagus was patent throughout and was separated from the trachea. Both the stomach and the first part of the duodenum were very dilated, and contained thick buff mucinous material. Though widely dilated, the pylorus maintained its entity before expanding into a spherical dilatation four centimetres in its greatest diameter. This dilatation ended blindly (see Figures I and II), an intervening area (which was found to consist of pancreatic tissue) separating it from the entry of the bile duct into the distal segment of the duodenum.

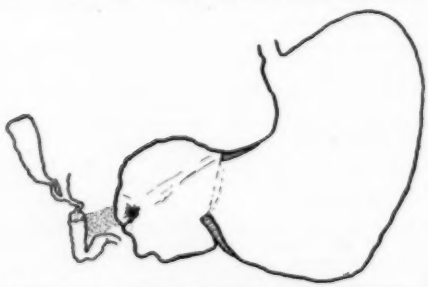

FIGURE II. Diagram showing discontinuity between first and second parts of duodenum in D4. Pancreas occupied the area which is stippled.

The interior of the first part of the duodenum was marked by a funnelled depression at the distal end, and toward this depression ran a thick fold of mucous membrane, the origin of the fold

being at the duodenal margin of the pylorus. In the depths of the depression was an opening in the mucous membrane—an opening which was considered to be an artefact, because it did not communicate with the serous surface of the duodenum. The gall-bladder contained bile, was not distended, and its cystic duct joined in a normal way with the hepatic duct. The common bile duct entered the second or descending part of the duodenum at its proximal end, the point of entry being on the postero-superior aspect of a dome-like eminence. Section of the wall of the duodenum exposed a pancreatic duct. The duodenum and the remainder of the small bowel were patent, and contained green-tinted semi-solid material. The external calibre appeared diminished. The large bowel and anus were patent and no other abnormalities were found. No histopathological examinations were made. The diagnosis was congenital atresia of the first part of the duodenum.

FIGURE III. The stomach, duodenum (cord) and some of the pancreas in specimen G.

Clinical Notes on G.

The infant, a full-time female, was born at the Women's Hospital, Crown Street, Sydney, on October 19, 1937. The birth weight was 6 pounds 12 ounces (3,067 grammes). The pregnancy was complicated by hydramnios. The infant vomited daily from birth, while records show that the vomiting was projectile at times. On the third day the vomitus was stated to be yellow, and on the sixth and subsequent day it varied from brown to black. No record is available concerning her motions before the third day, but meconium was passed during that and the next day. After that, the motion was either yellow or brown. The presence of peristaltic waves for jaundice was not mentioned. The infant died on the thirteenth day.

Post Mortem Examination.—The first examination was made by the hospital pathologist, and then the stomach and bowel were forwarded to the university. The details of both examinations are combined.

The stomach was greatly distended and had extended into the pelvis. It measured 7·5 centimetres in its greatest length. The first part of the duodenum resembled an ovoid sac (Figure III), and the diameter was 3·5 centimetres. On the ventro-superior border of the duodenum was a mass of pancreatic tissue which occupied one-seventh of

the ventral surface, and, straddling the superior border, slightly encroached on the dorsal surface. From the depths of this tissue emerged a white cord one millimetre in diameter. It ran for a distance of 13·0 millimetres, before expanding into a tube whose external diameter was 4·0 millimetres. The total length of the cord and tube was 6·7 centimetres. The tube had been cut at this point and macroscopically appeared to be small bowel. An incision had been made posteriorly, to determine a possible connexion between the dilated duodenal sac and the cord. No connexion was found (Figure IV) after lipiodol was injected under pressure into the tube distally.

FIGURE IV. In the upper illustration the appearance is shown after the injection of lipiodol distally. The lower illustration shows barium in the duodenal sac. The area intervening between lipiodol and barium represents impervious cord.

On dissection, the cord was found to commence blindly about 18 millimetres from the surface marking of the pylorus, and its course was upward and oblique, pancreatic tissue ensheathing it. Three smaller cords accompanied it for a short distance, one, running a superior and parallel course, being intimately bound to the principal cord. The distal end of the tube was patent for 5·1 centimetres; thus by calculation the total length of the cord which would not admit a probe was 1·6 centimetres. The pancreas, cord and smaller cord had a common attachment to the serous coat of the duodenum.

The original notes did not supply the details of the gall-bladder and the bile ducts, and the following notes were added later: "The gall-bladder was distended. The bile ducts appeared normal, the common bile duct entering the cord where it lay next to the dilated portion of the duodenum."

Histopathological Findings.—As a control, a block of tissue containing duodenum, bile papilla, common bile duct and pancreatic duct from an apparently normal full-time fœtus was sectioned and examined. Attention was focused on the bile and pancreatic duct. In each case the epithelium is columnar, though the cytoplasm is more abundant in the columnar cells of the bile duct. This is not apparent when a small bile duct is compared with a medium-to-large pancreatic duct—in fact the point of distinction is unrecognizable on that ground. The chief distinguishing feature in the largest ducts rests on the presence of goblet cells—plentiful in large bile ducts, scarce in the pancreatic duct.

In the abnormal specimen sections were made from blocks taken at the areas indicated in Figure V. Representative drawings from photographs of the serial section are shown. They are from

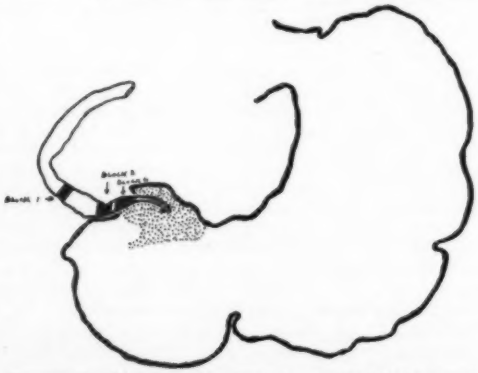

FIGURE V. Diagram showing whence the blocks were taken. The stippled area represents pancreas.

blocks 2 and 6. The discussion of the sections incorporates references to the drawings (Figure VI).

Block 1 shows an absence of villi, but the general structure is normal. Very few Brunner's glands are seen.

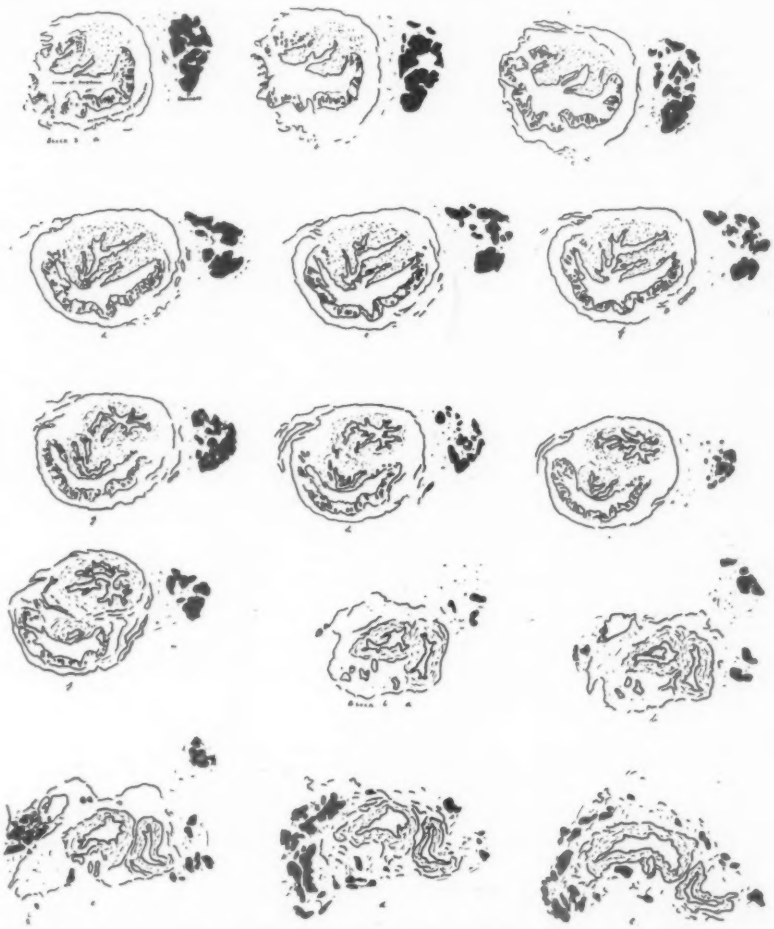

FIGURE VI. Drawings made from serial sections of specimen G. No attempt to include cellular detail has been made; reference to this appears in the text.

Block 2 exhibits a more pronounced formation of villi, and Brunner's glands are more numerous. The lumen of the bowel is decreased in calibre, and the mucous membrane does not encircle it completely. Both external muscle layers are weakly represented, especially the outer longitudinal. A tongue of fibrous tissue fills the deficiency in the ring of mucous membrane (2, *a*, *b*). As the sections approach the stomach this tongue becomes more prominent, and at the same time a fissure appears and ultimately branches (2, *c*, *d*, *e*, *f*). High columnar cells line this fissure, and

scattered goblet cells can be seen. Eventually the fissure is converted into ducts (2, *g*, *h*, *i*), each possessing a columnar lining. Coinciding with the appearance of the ducts, the lumen of the duodenum narrows and disappears (6, *a*). The transverse section now consists of two ducts supported by a well marked fibrous ring, the lumen being lined by an interrupted layer of columnar epithelium containing goblet cells. Pancreatic lobules, loosely bound together, almost ensheath these ducts. Block 6 (*a*, *b*, *c*, *d*, *e*), which is continuous with block 2, demonstrates two fibrous rings within which are some clumps of columnar epithelium. In some of the sections these are lying free.

Blocks 3, 4 and 5 produced no relevant material.

From the microscopic data the following reconstruction is permissible (Figure VII). The duodenum ascends proximally, the lumen progressively decreasing in size. The point at which it narrows perceptibly is indicated internally by a low papilla. Into this papilla opens a duct lined by high columnar epithelium containing goblet cells. This duct bifurcates, but retains the same microscopic character. The general evidence favours the assumption that these are components of the biliary tree, and thus the specimen resembles D4.

FIGURE VII. Reconstruction from sections in specimen G. The duodenum ends blindly and is succeeded by bile ducts.

The diagnosis is congenital atresia of the first part of the duodenum.

Discussion.

The terminology used in describing developmental abnormalities of the duodenum is often misleading. Four terms in common use are: stenosis, atresia, stricture and occlusion. Mistakenly, those four terms have been regarded as interchangeable, and, with the addition of qualifying words such as partial or complete, have tended to create a difficulty which is met in a search for references.

The essential information concerning each word is as follows. Atresia, derived from the Greek, means "not perforated". Occlusion, derived from the Latin, means "a shutting off". Stenosis, derived from the Greek, means "a narrowing". Stricture, derived from the Latin, means "a binding, tightening". Stricture was first used in 1400, when it was spelled with two c's. Occlusion was introduced into medical language in 1645 by Howell, while the use of atresia (Peacock) and stenosis (Flint) is comparatively recent (1866).

The correct use of these terms would ensure accuracy of expression and consequent uniformity in description. Also it would dispense with the need to supply further qualifications, such as partial and complete. To bring this contribution into line with the above remarks, the term congenital atresia is incorrect, because the word atresia, by definition, conveys the time and spatial relationship adequately.

Numerous theories have been advanced in an attempt to account for the condition. Of the early theorists, Meckel assigned the cause to a failure of coalescence of the gut, which he believed developed segmentally. Streubel and Valenta sought to explain atresia by the action of a volvulus.

A convenient grouping of the theories is as follows:

1. Developmental:
   (*a*) At the site of an embryological event.
   (*b*) Arterial defect.
2. Mechanical:
   (*a*) Kinking.
   (*b*) Volvulus.
   (*c*) Snaring of the bowel at the umbilicus.
3. Pathological:
   (*a*) Fœtal peritonitis.
   (*b*) A group of rare incidents, including ulceration, intussusception, hypertrophy of *valvulæ conniventes*, mesocolic pressure, pressure from a mesenteric cyst, and antenatal carcinoma.

Obviously some of these theories cannot apply to cases of atresia of the duodenum. Their introduction, indeed, represents an effort to secure an economy of hypothesis, so that atresias occurring at other areas in the alimentary tract may be accommodated. The result has not made the situation less complex.

An examination of statistics of the site involved in the duodenum shows that most cases occur about the level of the papilla. Cordes found that more than two-thirds occurred about the level of the papilla in her series of 57 cases, while slightly higher figures (72%) were recorded by Spriggs. Owing to incomplete data, both investigators were not able to classify all cases.

Simpson's opinions regarding fœtal peritonitis were based on specimens, the youngest of which was four months old. He had also "observed unequivocal evidence of inflammation . . . earlier than that mentioned by Velpeau" (third month). Against this Clogg wrote: "Single atresia is more common than multiple . . . it seems almost incredible that the only effects of a fœtal peritonitis can be a constriction of one portion of gut and that it may leave no further trace. . . ."

Snaring of the bowel at the umbilicus and volvuli could barely, if at all, affect the first and second parts of the duodenum; firstly, because an error in location or attachment of that part of the foregut down to the level of the biliary papilla is excessively rare; secondly, because it might be expected that stenosis would be more common in such events, whereas the proportion was 48 atresias to 9 stenoses in Cordes's series (quoted by Clogg); and, thirdly, it is known that single lesions outnumber multiple. With regard to kinking, Spriggs stated that in nearly all the cases which he reviewed, this accident occurred at the duodeno-jejunal junction. This of course is not the classical site for the duodenal lesion. Possibly the theory might hold in a few cases, yet stenosis rather than atresia would be expected.

The evidence of arterial anomalies did not appeal to Clogg. He thought it inconclusive and asserted that their "role . . . is practically nil". Bland Sutton's generalization was made when he reported a case of imperforate ileum. He expressed the opinion that congenital narrowing and obstruction are always found in the situation of embryological events. The application of this theory to his own case is not clear; in respect of multiple atresias it is even more nebulous.

The blockage of the lumen of the duodenum in the fifth and sixth weeks by an overgrowth of epithelium—an event which has been requisitioned to explain atresias—is doubted by Frazer, who, in referring to this phenomenon, said: "Occasionally it [the duodenum] seems to be blocked completely, but it is questionable whether this is normal or, at any rate, not accidental."

Ladd recently utilized Tandler's theory of epithelial occlusion when he suggested that a failure to find keratinized epithelium (swallowed in the amniotic fluid) in the stools was an indication of atresia. Presumably the finding of keratinized epithelium below an area of atresia would help to fix the time when the atresia had occurred, that is, after the sixth week of embryonic life, when amniotic fluid and its contents could reach the large bowel.

It must be concluded from the above remarks that no one view can explain all cases—a view put forward by Spriggs in 1912. The developmental theory of origin, though it does not provide an explanation why the abnormality occurs, favours an embryonic (to the eighth week) rather than a fœtal view.

A list of significant literature is appended.

Acknowledgements.

My thanks are offered to the Department of Pathology and to Dr. B. Durie for the specimens; to Dr. Grogan (Renwick Hospital), who facilitated the compilation of case notes; to Mr. Finlayson for the preparation of the histological sections; and to Mr. Woodward Smith for the photography.

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The Australian and New Zealand Journal of Surgery.

All articles submitted for publication in this journal must be typewritten and double or treble spacing should be used. Each article should conclude with a brief summary and statement of conclusions. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

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SURGERY AND RESEARCH.

NOBODY questions the value of experimental surgery and medicine to the practice of surgery, but in many minds there is an intolerant attitude to any research which has no apparent practical application. It is worth while, therefore, to consider the value to surgery of this class of research.

Valerius Cordius when he discovered sweet oil of vitriol (ether) in 1540, Priestley when he discovered nitrous oxide in 1776, and Liebig, Soubeiran and Guthrie when they discovered chloroform in 1831, were not searching for anæsthetic agents. When, in the last decade of the eighteenth century, the academicians Davey and Faraday suggested the use of nitrous oxide and ether, respectively, for the alleviation of pain, the profession paid no attention. It was not until forceful members of the medical and dental professions investigated these substances fifty years later that the profession became aware of them as anæsthetic agents. One cannot refrain from noting how well these products of academic research compare with the latter-day products of houses which employ, for the purpose of developing anæsthetic agents, practitioners of a much advanced chemistry.

Pasteur's researches gave the basis to Lister's gift to surgery. In this case, however, Pasteur himself perceived the importance to medicine of his discovery. Lister found it hard enough to convince the profession; how

much more difficult would it have been for Pasteur, how many lives would have been needlessly lost in the meantime, if he had not this eminent advocate and applier of principles to aid him?

Röntgen had no thought of X ray diagnosis as he experimented, nor had the Curies any conception of the future surgical application of radio-activity. But with these discoveries we see an increasing awareness on the part of the medical profession, probably because of their better training in the basic sciences of medicine. As contrast, though three hundred years were required in the case of ether, now a few months or years saw the new agent in world-wide practice.

But there are other discoveries of science which the profession has not accepted so readily; perhaps the most important of these is statistical method in assessing the value or otherwise of forms of treatment. Those famous surgical expressions "we always", "we never" take no cognizance of the normal frequency curve and "our experience shows" may be less troublesome, but is also less exact than a statement of statistical significance.

These, then, are examples of research in chemistry, physics and biology which could give or are giving great service to surgery. It is obvious that it is impossible to say which research will produce results of the greatest importance to our subject. The physicist, chemist or academic or medical biologist will not always see the medical application of his findings, or, seeing, may be too easily rebuffed by the first uninterested practitioner he approaches. For surgeons who wish to gain new gifts for their science, it is, therefore, more imperative than impossible to keep abreast of progress in related sciences. In most communities he will be able to consult with a practitioner of one of these sciences as easily as with a specialist in another branch of his own subject. There can be no justification for neglect. Even though the advances may be few in number, unless history is a fallacious guide, the final achievement may be very great.

R. D. WRIGHT.

Surgery in Other Countries.

[In this column will be published short résumés of articles likely to be of practical value from Journals published in other countries and not readily accessible to surgeons in Australia and New Zealand.]

Operative Treatment of Syndactylism.

H. Stephan: "*Beitrag zur operativen Behandlung der Syndaktylie*", *Zentralblatt für Chirurgie*, 1939, Number 14, page 794.

For the operative separation of the skin and fibrous tissue for syndactylism many methods are described. The principles are: (*a*) Sufficient separation of fingers up to the height of the interdigital fold. (*b*) Protection of the bifurcation of vessels at the fold. (*c*) Formation of sufficient interdigital fold from the available skin. (*d*) The provision of sufficient skin to cover all bare areas left or else the attainment of spontaneous epithelialization.

The simple separation operations were followed again and again by trouble from the raw interdigital fold. In 1810 Zeller covered the interdigital fold with a triangular skin flap, fixed on the palmar surface, but it was often too short and the use of tension on sutures resulted in sloughing. Various plastic operations fail because sufficient skin is not available. Scar formation and contracture are always the bugbear. Friedrich suggested skin flaps from the breast or abdomen, but with this complication

Figure I.

Figure II.

of technique no improvement resulted. A lasting success is dependent upon good epidermization of the interdigital fold. Klapp's method is described by the author, that is, Thiersch grafting as in Figure I. Operation is performed in two stages. In the first stage the bridge at the interdigital fold is button-holed at the level of the knuckle joint. A complete Thiersch skin graft in one piece is spread over a piece of flat rubber folded twice and inserted into the gap previously made in the region of the

interdigital fold. To prevent the skin graft from shifting it has been sewn by its edges to the rubber strip by a few interrupted stitches (Figure I). After fourteen days the second stage is performed. The remainder of the skin bridge distal to the rubber strip is now cleanly divided and no flaps are made (Figure II). After-treatment now begins. The fingers are held in a spreading splint; the wounds are dressed with "scarlet red" ointment; after ten days exercises are started. Finally, the fingers are freed during the day and are placed on the separating splint only at night. Treatment in three patients is reported.

THOMAS KING.

HYDATID CYST OF THE PANCREAS.

L. I. Flanzik and I. A. Garber, Surgical Polyclinic, Ukraine: *Archivos Internacionales de la Hidatidosis*, Volume iv, 1938.

A CYST, two litres in capacity, diagnosed before operation as a liver cyst, complicated by cholecystitis and cholangitis, was successfully evacuated and drained on December 29, 1933, by Professor M. F. Shevandin. The patient was a youth, aged twenty years, and the cyst was found to be located in the head and adjacent part of the body of the pancreas. The authors refer to the rarity of the location, and state that less than 50 cases have so far been recorded in the whole world's literature.

L. E. BARNETT.

HYDATID CYSTS OF THE NECK.

Velarde Perez Fontana: "*Quistes Hidatidicos del Cuello*", *Anales de la Facultad de Medicina Montevideo*, Volume xxi, 1936, Numbers 4, 5, 6 and 7.

THIS monograph is an excellent work of reference for anyone specially interested in the unusual location of hydatid cysts in the neck. The author describes twelve cases in detail, and has combed the literature of his own and foreign countries for other instances.

There are good illustrations of cysts in the right supraclavicular region, the right carotid fascia, the back of the neck and the lymphatic glands. There are also several photomicrographs.

As a result of careful investigation, Fontana gives the following figures. In the public and private hospitals of Uruguay there were 2,616 patients with hydatid disease in the six years 1929 to 1934. Fifteen of the cysts were located in the neck (0·57%). In the hospitals of Argentina there were 3,096 cases in fourteen years (1922 to 1935), and of these twelve were in the neck (M. Castex and D. Greenway) (0·39%). In Iceland, in the year 1912, G. Magnussen collected 169 cases, of which two were in the neck (1·18%). In Sardinia, in the year 1925, F. Putzu recorded 474 cases, of which fifteen were in the neck (3·15%).

The possible and the probable paths of transport of the hexacanth embryo from the human intestine to its destination in liver, lungs or other parts of the body are discussed. These paths, in addition to the main road by way of the portal vein, may include the lymphatics and lacteals, the arteries, the peritoneal cavity and the connective tissues. The action of the digestive juices in the alimentary canal is not essential to the hatching out of the embryo from the hydatid ovum, and it is theoretically possible for certain cysts of the neck to occur as a result of direct penetration of the pharynx, tonsil, œsophagus or even of the skin. Landivar in 1913 collected 29 cases. Runge in 1919 collected 32 cases.

Hydatid cysts of the thyreoid gland are usually mistaken, at least to begin with, for cystic goitres.

The clinical features, those of irritation and those of pressure combined in various degree, are very similar. The high tension of the typical hydatid cyst should be suggestive, and in hydatid countries the clinician should, of course, have a "hydatid conscience". Amongst other symptoms and signs there have been noted cough, hoarseness, altered or lost voice, dyspnœa, recurrent laryngeal paralysis, sympathetic myosis, compression and displacement of trachea, rupture of the cyst into the trachea (sometimes fatal, sometimes curative) *et cetera*.

Hydatid cysts of the parotid, submaxillary and sublingual salivary glands have all been noted as surgical curiosities, and the same remark applies to cysts of lymph nodes, tonsils and pharynx. Hydatid cysts in muscles or the fascia of muscles are not very uncommon. In a tally made by Herrero Vegas and Cranwell, out of 970 cases of

hydatid cysts, 40 were of this location, and of these three were in the sterno-mastoid region. Rare cases of cysts involving the trapezius muscle are also referred to.

Other rare fascial types are subcutaneous, perivascular, perineural and so on. Two cases of fatal hæmorrhage from erosion of a subclavian artery are described.

Instances of invasion of the cervical vertebræ are given and also a description of Putzu's remarkable case of a cyst originating in a great cornu of the hyoid bone. This occurred in a girl aged twelve, reached the size of a hen's egg and caused pressure troubles. It was at first diagnosed as a branchial cyst.

L. E. BARNETT.

BLOCKAGE OF THE SPINAL CANAL WITHOUT EVIDENT CAUSE.

Dr. O. Haffner, Tübingen: "*Myelographische Stops, ohne erkennbare Ursache*", *Der Chirurg*, March 1, 1939.

THE use of contrast media to demonstrate stenoses of various sorts in the spinal canal has become a routine procedure among neurologists; and the blocking of the contrast medium at a spot corresponding to that clinically determined as the level of a probable lesion is now a necessity in deciding upon laminectomy.

There are, however, cases in which the contrast medium is arrested at a spot in the canal without obvious cause. Some are due merely to a holding up of the medium at the physiologically narrowed region between the first and fourth dorsal vertebræ; and the occurrence of these depends on the viscosity of the oil used or on minor errors in technique. The position is different in those cases in which the medium is arrested exactly at the spot which clinical examination would indicate as the level where it might be expected to be blocked, and yet at operation no cause for the arrest can be found, although the patient's symptoms disappear after it.

F. Krause reported such a case in 1928, in which the clinical symptoms indicated a partial block in conduction in the lower cervical and upper dorsal regions; four cubic centimetres of "Iodipin" given by cisternal puncture remained arrested at the seventh cervical vertebra for eleven days, at which time he was operated upon. At operation nothing whatever was found to explain the symptoms or the arrest of the "Iodipin". Nine days later the patient died of bronchitis and circulatory failure; and a careful *post mortem* examination, including microscopic study of the cord and membranes, revealed no abnormality except a mild thickening of the dura, which was attributed to a reaction to the iodine.

Lichtenauer presented a similar case at the North-West German Surgical Congress at Rostock in 1937; a forty-three year old man developed the symptoms of a complete transverse lesion in the upper dorsal levels, the first symptoms arising ten days after a febrile attack. "Iodipin" was arrested at the level of the first to third dorsal vertebræ, but operation disclosed no lesion of any sort, and the patient made an almost complete recovery.

Haffner now reports a third case which clinically indicated a cord lesion in the lower dorsal region, and in which one cubic centimetre of lipiodol was arrested at the level of the seventh and eighth dorsal vertebræ. Arachnitis was diagnosed, but on laminectomy the dura, arachnoid and cord were entirely normal. Immediately following the operation the symptoms resolved, and in six months' time no trace of the trouble could be found on clinical examination.

Haffner then asks why the contrast medium was so arrested. The exact correspondence between the X ray appearances and the neurological findings is evidence that there must have been some pathological cause present. That this is not a disseminated sclerosis or a myelitis was proved at least in Krause's case. It would be possible for improvement in disseminated sclerosis to be associated with operation, for such cases have been reported; but they are rare, and the more usual condition is a deterioration. Circulatory changes in the blood, lymph and cerebro-spinal fluid systems can cause œdema and metabolic changes in the cord and its membranes; and such œdema can cause blockage of lipiodol. The changes are generally associated with inflammatory processes in the vertebral bodies. Guttmann reports a case in which clinical and X ray findings coincided in indicating a cord compression at the level of the third and fourth dorsal vertebræ, but some days after the myelography a sudden improvement in the symptoms was noted, and an ascending myelography showed a clear passage of the medium right up the canal. The patient died from a pulmonary embolus, and a study of the cord revealed that the arteries were occluded in places by arteriosclerotic changes, with swelling of the cord, and blockage of the canal at its physiologically narrowed

spot. This condition was, however, certainly not present in Krause's case; and such decided improvement as occurred in the other reported cases would hardly be expected if it were the cause in them.

The actual pathological condition is most likely the formation of exceedingly fine arachnitic adhesions, so fine as not to be detectable at operation. This is a very possible condition. Even macroscopically visible adhesions in this region are often so delicate that one is surprised to think that they could cause arrest of lipiodol. In the surgical exploration they are separated or cut, and this originates the post-operative improvement. Lichtenauer's case particularly corresponds closely to the clinical picture of *arachnitis adhæsiva circumscripta*. Its onset after a "*grippe*" is especially characteristic. The increased severity of the symptoms following myelography would be explained by the further circulatory disturbance caused by it. The possibility of compression of the cord by adhesions not visible to the naked eye was discussed earlier by Loesch, in a case in which the clinical findings were so definite that no myelography was done. Nothing was found at the operation, but immediate improvement occurred after it; and Loesch mentioned briefly some other similar reported cases. He formed the opinion that a regional arachnitis can cause symptoms without any macroscopic changes.

Some of the cases of temporary arrest of the medium in myelography also support this theory. Denk mentions a case, clinically one of compression at the sixth dorsal vertebral level, with arrested medium at the third to fifth, in which after three days the medium was found to be no longer arrested there. He was inclined to assign the credit for this either to the mechanical effect of the iodol used or to a specific effect of the iodine on the inflammatory process. Viewing Herzog's case of temporary block, it would seem more likely that the effect was produced by the separation of the adhesions. Suboccipital injection of three centimetres of iodol was followed by a stop at the level of the second cervical vertebra, still unchanged ninety-six hours afterwards. But eight days later the blockage had vanished, and there had been in the meantime a great improvement in the symptoms. Schaltenbrand supplies the proof that it is possible so to separate arachnoidal adhesions, in a case in which he injected air into the canal, with sudden release of the block and easing of the symptoms. It cannot be definitely proved that in Denk's case and in that of Herzog there actually was a regional arachnitis, and that the weight of oil separated the adhesions; but there is so close a connexion between the X ray appearances and the clinical improvement that it appears reasonable to assume it. If the iodine injected had a specific action, improvement should follow more often in cases of arachnitis in which myelographic examination was made. In Schaltenbrand's case the diagnosis is proved. Of the others, only in Krause's case can the diagnosis of arachnitis be confidently assumed; but that this same diagnosis would have been correct in the other cases also is at least probable. Adhesions so fine as to be separated by the weight of the iodized oil used, or by the pressure of an air bubble, would not be likely to be very evident to the naked eye. The fact that operation was followed by cure indicates that at the site of operation there was some pathological process which the operation eliminated.

ARTHUR E. BROWN.

PANCREATITIS.

J. Meyer-May (Hanoi): "*Les pancréatites atténuées*", *Journal de Chirurgie*, August, 1939.

MEYER-MAY writes, from Indo-China, an article on pancreatitis, the main interest of which lies in his methods of diagnosis and treatment. He heads his paper "The Milder Forms of Pancreatitis" because he does not include any of the hæmorrhagic cases with fat necrosis, which, he says, he has not seen there. The case descriptions, however, indicate that short of this group he is describing a fairly severe form of the disease. His material consists of 27 patients suffering from conditions primarily pancreatic, of whom 9 were treated surgically and 18 medically; and six patients who were shown to be suffering from pancreatitis in association with gastro-duodenal ulceration. The pancreas, when examined, was seen to display two pathological types, the œdematous and the sclerotic. The ætiology is peculiar in that in very few instances was the condition found to be associated with gall-stones, but nearly all cases were associated with ascaris or trichocephalus infestation, ascarides being found in the duct of Wirsung in some instances. In view of the fact that up to 88% of the inhabitants of Indo-China are infested with these helminths, this is not so surprising as it would be if such an association were recorded in Australia.

Clinically the symptoms mainly consist of paroxysmal pains of the well-known type, gross loss of weight and digestive disturbances. In the differential diagnosis of these cases from other abdominal catastrophes, such as perforation, great stress is laid on the absence of the hard board-like rigidity found in perforation. In pancreatitis resistance of the abdominal wall is present, and pain is noted on palpation, but not the hard rigidity.

Laboratory tests are very important, the two principally used being the estimation of the blood sugar content (which is found to be raised) and the estimation of the ferments contained in the pancreatic juices withdrawn from the duodenum by tube suction. In regard to this latter investigation, Meyer-May's use of the word "diastase" is somewhat confusing. He says, for instance, "*L'insuffisance diastasique du suc pancréatique, est très marquée sur les trois diastases*", and we have to assume that he uses the term "*diastase*" as synonymous with the word "ferment", not limiting it as is our usage to a starch-splitting ferment. The deficiency in lipase is the most pronounced (its index falling from 50 or 60 to 0·15). Trypsin is next in order of insufficiency, and amylase shows a definite though less marked fall in value also. Details of Meyer-May's method of estimating these ferments are given in the paper.

The standard of blood sugar taken as indicating a pancreatitis is a rise to above 1·10 (the normal reading among the Tonkinese being 0·88). As, however, other acute abdominal conditions may occasionally cause a similar rise in blood sugar content, Meyer-May considers that the analysis of the pancreatic juice is the most important single examination to be made. The actual operation of passing the tube, he admits, is difficult in bad cases, and, in fact, he succeeded in doing so only in six of his cases before operation. In all these, however, the ferment content was greatly lowered, the falls being greatest in the order: lipase, trypsin and amylase. In spite of this difficulty, he has not found it necessary in diagnosis to estimate the diastase content of the blood or urine. A further confirmatory test of a correct diagnosis is in the reaction of the patient's condition to the therapeutic injection of insulin.

Treatment in Meyer-May's hands is becoming less surgical and more medical, surgery being regarded by him as designed rather to meet a crisis than to treat the cause. Medical treatment consists in the administration by injection of from 15 to 45 units of insulin daily, and in chronic or subacute cases is continued until the blood sugar reaches a normal level. In acute cases the pains subside so strikingly that operation can often be avoided. In chronic and subacute cases the blood sugar level falls, the general condition improves, weight is put on rapidly, and the ferment content of the pancreatic secretion returns to normal or nearly normal.

The paper is well documented with case reports, and it ends with the following conclusions.

1. Excluding the hæmorrhagic cases, of which the author has no experience, operation is not urgent in acute pancreatitis.

2. Duodenal intubation should be practised more often in cases in which pancreatitis is suspected, and the blood sugar content should be estimated.

3. In an apparently urgent surgical case, in which a definite diagnosis has been made, the injection of 15 units of insulin will often surprise the surgeon by removing all the appearance of urgency in a couple of hours.

ARTHUR E. BROWN.

Reviews.

OPERATIVE SURGERY.

Royal Northern Operative Surgery. By the Surgical Staff of the Royal Northern Hospital; edited by Sir Lancelot Barrington-Ward; 1939. London: H. K. Lewis and Company Limited. Super royal 8vo, pp. 564, with 463 illustrations. Price: 42s. net.

THE surgical staff of the Royal Northern Hospital has been responsible for a new volume of about 550 pages on operative surgery, which is well illustrated and attractively produced. This book should be read only after a full appreciation of the objects as set forth in the preface. Modern surgical technique being what it is, such objectives would

seem to be an almost impossible ideal; although the aim has been "to help and refresh the practising surgeon", it would appear to achieve this only in certain particulars.

Outstanding chapters are those dealing with the colon and rectum, limbs and neck, whilst that on surgery of the kidney also maintains a high standard.

The first chapter in the book, dealing with the head, is unfortunate and its sketchy character creates an early unfavourable impression. Sound general principles underlying the treatment of hare-lip are given, but more detailed description of the finer points in technique would be appreciated by many surgeons. We should like to believe that the secondary operations for widened nostrils were as simple and successful as the illustrations suggest, whilst it is somewhat surprising to find that the modern methods of palatoplasty are ignored. The modified Buthin's operation for leucoplakia of the tongue is sound, and deserves more general use in selected cases.

It is difficult to understand why the authors should include the case history relating to fractured mandible on page 37. From this a wrong impression may be gained of the method of treatment of these fractures, as the more accepted technique of management is omitted.

The technique of introducing a cartilage graft for the correction of saddle nose produces an unnecessary scar, but it is not one which we would recommend.

The section dealing with surgery of the thorax provides the general surgeon with a useful epitome of modern methods, although the treatment of hydatid of the lung would not meet with approval in this country; nor would we advise that the drainage tube be removed from an empyema in "four days".

The chapters on abdominal surgery are generally of a high standard, but, as in many other parts of the book, lengthy descriptions of unimportant or antiquated procedures are given where space might well have been devoted to more important subjects. Many surgeons continue to wonder at the space devoted to such subjects as Battle's incision and appendicostomy (the latter occupies two pages with three illustrations), whilst no mention is made of terminal ileitis.

Regarding operations for hernia, we should like to have seen some reference to the use, and method of production, of local anæsthesia, which has many advantages; to omit reference to sliding hernia is surely an oversight.

As in all limited volumes, the decision to omit or include certain subjects proves a very difficult problem, but in the section on fractures some mention of the operative treatment of bumper-bar fractures of the tibial condyles would have been valuable, whilst we are doubtful whether the description of division of the sensory division of the fifth nerve, which occupies sixteen lines and is unillustrated, could be of any use to an operator.

TREATMENT BY MANIPULATION.

Treatment by Manipulation in General and Consulting Practice, being the Third Edition of "Manipulative Surgery". By A. G. T. FISHER, M.C., M.B., Ch.B., F.R.C.S.; 1939. London: H. K. Lewis and Company Limited. Demy 8vo, pp. 270, with 68 illustrations. Price: 12s. 6d. net.

IN this manual Mr. Timbrell Fisher deals with a grossly neglected aspect of surgery in a practical and illuminating manner. The opening chapters deal briefly with the history of the neglect of manipulative surgery since the days of John Hunter, and pay just tribute to the memory of men—lone voices crying in the wilderness—such as Paget, Hood and Robert Jones; the author also mentions the not inconsiderable influence of numerous unqualified "bone setters" in bringing to the notice of the public the benefits that might be derived from manipulative treatment. Osteopathy and the doctrines of A. T. Still are briefly but faithfully dealt with; but details of the inquiry of the select committee of the House of Lords into the *bona fides* of osteopathy are of no real scientific interest and should be omitted from subsequent editions.

In the author's opinion, relief from pain or a dramatic "cure" of some intractable joint condition following treatment by manipulation is usually due to the breaking down of adhesions which should never have been allowed to occur. The pathology of the formation of adhesions in joints and also in muscle and fascial planes is discussed in some detail, as well as the occurrence and subsequent absorption of joint effusions—"the glue from which adhesions are made". Throughout subsequent sections the author's views as to how adhesions may be prevented are clearly set out and reiterated—as he admits, at the risk of boredom. In brief, early movements of all joints, the site of or

in the vicinity of injury, are advised; and the author claims that these movements do not delay resolution, but generally accelerate it, promote the absorption of effusions, and prevent the formation of adhesions. While most may agree with the last claim, not all will agree that all the tenets of Hilton should be ruthlessly discarded. Most surgeons have experienced instances in which rest of an affected joint or limb has alone been responsible for the complete relief of at least some of the conditions that are cited as absolute indications for manipulation, and even more often in which a joint exhibiting some limitation of movement following trauma, immobilization, or both, has regained its complete range of movement without recourse to any treatment other than free active use of the limb. In fact, the one real criticism that can be levelled at the author is that he over-emphasizes the indications and advantages of manipulation at the expense of other recognized and proved methods.

Methods used by Mr. Trimbrell Fisher in the manipulation of individual joints are given in detail, and are preceded in each case by a brief *résumé* of the salient features of the surgical anatomy of the joints and an accurate description of their normal movements. Many excellent illustrations of grips and manœuvres used during various manipulations are included, and the author is to be particularly congratulated on this score, because, as he states, manipulative surgery is largely a matter of personal technique, or "knack", and is particularly difficult to pass on, either by description, illustration or even demonstration.

Special sections are devoted to chronic arthritis in its various forms, and proper emphasis is laid on the generally accepted dictum that "movement is life". The treatment advised is in general accord with, at any rate, modern orthopædic practice, and emphasis is laid on the advantages of rest in the optimum position of individual joints in the early acute phase of infective or so-called rheumatoid arthritis. The author claims considerable degree of success from manipulation of the gnarled, distorted joints in advanced, quiescent chronic arthritis. This has not been our experience. In fact, in spite of the claims made in this book, we still think that elbows and fingers are best left alone, especially in those cases in which we know from previous experience that an excellent economic range of movement will eventually return, provided intelligent cooperation from the patient is obtained in the diligent performance of active movements. It must be stated in fairness that Mr. Timbrell Fisher repeatedly warns his readers of the harmful results of too vigorous manipulations, resulting as they do in considerable trauma to joint structures, with subsequent fibrosis, contractures, and often increase in stiffness.

The sections dealing with back pain and sciatica are generally in accordance with modern orthopædic teaching, and here again the salient points of the anatomy and pathology of the various types of lesions and a brief note on the extremely complex matter of differential diagnosis are both helpful and instructive.

As one would expect from a competent orthopædist, the contraindications to manipulative treatment, particularly tuberculous disease of bones and joints, the presence of neoplasms or *myositis ossificans et cetera*, are constantly emphasized. Personal supervision of the after-care is regarded as essential if ultimate success is to be achieved, and active, rather than passive, movements are advised at this juncture. It is good to note that the application of heat, either as a preliminary to or during muscle reeducation, is recommended, since this very helpful adjunct is so often forgotten.

Well selected cases from the author's extensive practice are cited to illustrate and emphasize the successful results obtained from the various manipulations advised. The book represents a useful and practical addition to orthopædic literature and one on which Mr. Timbrell Fisher is to be sincerely congratulated.

PROCTOSCOPIC EXAMINATION IN DIARRHŒA.

Proctoscopic Examination and Diagnosis and Treatment of Diarrheas. By M. H. STREICHER, M.S., M.D.; 1939. Springfield, Illinois: Charles C. Thomas; London: Baillière, Tindall and Cox. Medium 8vo, pp. 150, with 39 illustrations. Price in America: $3 (post paid).

IT is difficult to understand the object of this small book. The chapter on the method of introduction of the proctoscope, which is about 10 inches long (as distinct from the sigmoidoscope, which is described as being 12 inches long), is good, provided one

favours the knee-elbow position, and there are seven illustrations of proctoscopic appearances of different conditions. Beyond this, however, the book consists merely of a tabulation of the various causes of diarrhœa, no reference being made to proctoscopic appearances in most instances and inadequate notes on treatment being given. In this country, surgeons would never instruct patients upon whom they wish to make a proctoscopic examination to "use enemas until the returns are clear", nor would they consider it necessary to explain to a patient that the examination would be conducted in privacy. A discussion of the relative merits of surgical excision and radiotherapy for carcinoma of the rectum is out of place in a monograph on diagnosis of diarrhœa. There are several mistakes in grammar, and the spelling in many places can only be described as original.

Proceedings of the Royal Australasian College of Surgeons.

SOUTH AUSTRALIAN MEETING.

A MEETING arranged by the South Australian State Committee was held in Adelaide on February 14, 1940. The following programme was presented:

Verco Theatre, Institute of Medical and Veterinary Science, at 11.15 a.m.—Discussion on malignant disease of the lung. Speakers: Dr. G. A. Lendon (who had been invited to introduce the subject from the medical point of view), R. M. Glynn, A. Britten Jones. A general discussion followed.

Verco Theatre, Institute of Medical and Veterinary Science, at 8.30 p.m.—Lecturettes: Sir Henry Newland, "Perforating Wounds of the Abdomen"; L. C. E. Lindon, "Perforating Wounds of the Skull". A general discussion followed.

Notices.

NEW DEVELOPMENTS IN SURGICAL EQUIPMENT.

THE attention of Fellows is drawn to pages xx and xxx among the advertisements, which illustrate some recent developments in surgical equipment. The Editorial Committee is responsible for the selection of the equipment illustrated thereon. The publishers will be pleased, whenever possible, to supply the names and addresses of the manufacturers to anyone requiring such information.

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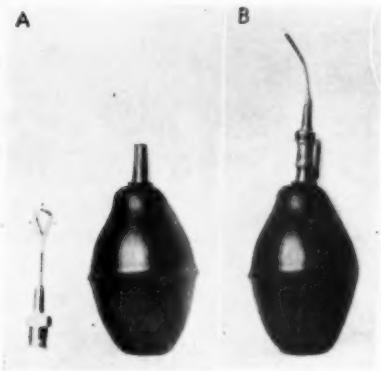

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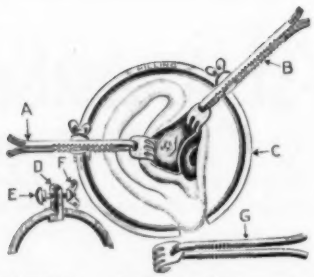

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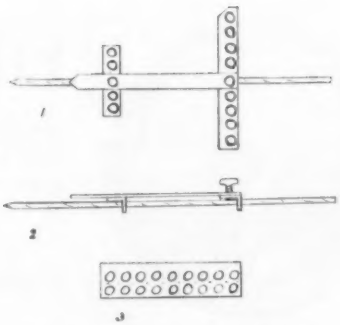

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(C. Fred Ferciot, M.D., Lincoln, Nebraska, *The Journal of Bone and Joint Surgery*, Volume XXI, Number 4, October, 1939, page 1023.)

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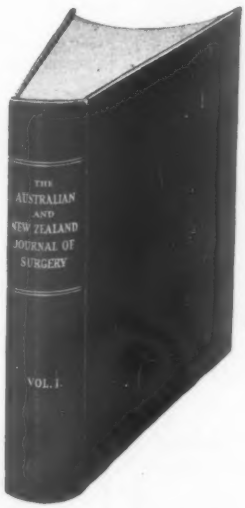

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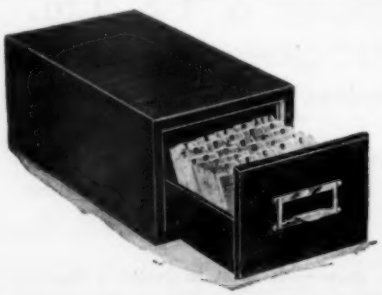

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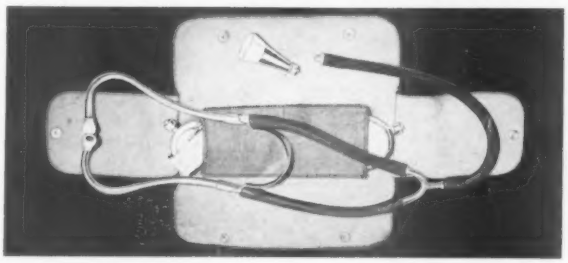

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